RAILROAD GAZETTE

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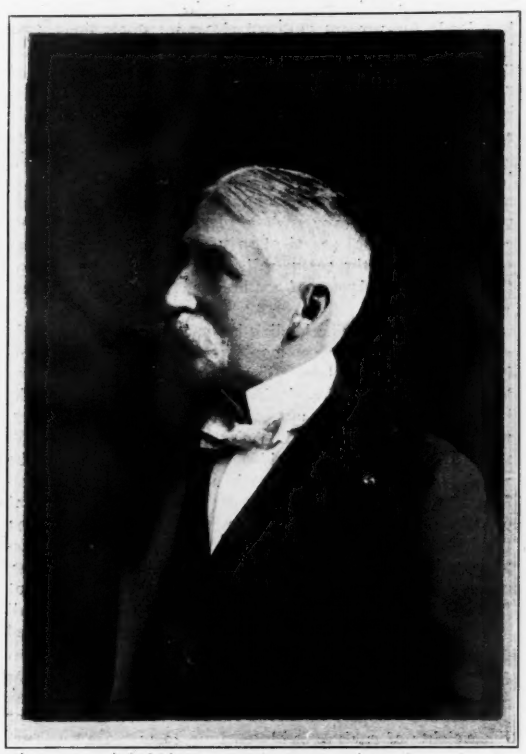
Colonel Bailey.

For 20 years Col. James H. Bailey has been an owner and a powerful influence in the *Railroad Gazette*. He retires, in what some of us like to call the prime of life, from active work in order, as he would express it, to enjoy life while he is still young enough to enjoy it. His work has been such as to give him an opportunity to be personally known to an enormous number of important and influential men, the captains of industry in this country during two decades of marvelous development, and his dignity of character and earnestness have won friendships among them to an extent that is rare in business experience. This result has seemed curious to many of his friendly acquaintances, for his military carriage, somewhat severe manner, and intense earnestness gave no sign of popularity-seeking; but more than 2,000 years ago Cicero elaborated the thesis that friendship is founded on respect and on that alone. No one who knew Bailey in any relation, whether friendly or strenuous, ever failed to respect him.

When the civil war began in 1861 he was a lad of 15 years, finishing his course in the Fayetteville (N. Y.) academy, where Grover Cleveland once attended school. Inspired by the war fever, a cadet company was organized and Bailey was chosen its Lieutenant. But this uneventful service did not detain him long, for in the following year, 1862, he enlisted as a private in Company I, Third Regiment, New York Volunteer Cavalry. Apparently his patriotism and eagerness were accepted in lieu of his lack of the required age. He served with his regiment under General Burnside on his expedition to Newbern, N. C., where he had a chance to participate in all of the battles, skirmishes and mix-ups, for which the cavalry service affords such fine opportunities, during the campaign of the Eighteenth Army Corps, Department of North Carolina. Late in 1863 his regiment was ordered to Virginia and wintered at Newport News, but he was detached from his regiment for staff duty, and was made Adjutant of the outposts, including the control of the Dismal Swamp canal. It was in this service that he won recognition and frequent commendation, and, although he was the youngest soldier in his regiment, he was made Second Lieutenant when he went back to his regiment in 1864. In the Army of the James, under General Butler, who was "bottled up" at City Point, the cavalry was the only branch of the service which was kept actively engaged up to the time when Grant fought it out, on the line he had chosen, down to the works at Petersburg. He was in the famous Wilson raid around Richmond and on the retreat he was taken prisoner at Reams' Station, on June 29. His experience as a prisoner was one of a kind to leave a mark for life on his physique and his character. He was captured by General Fitzhugh Lee's cavalry and taken to Richmond, where he had the thrilling experience, with other prisoners, of being counted out, each tenth man to step forward and be locked up separately and held in trust to be shot if Secretary Stanton carried out his then determination to shoot certain rebel prisoners. His jail experiences at Salisbury, N. C.; at Macon, Ga.; Columbia and Charleston, were of such a bitter sort that it has always been difficult to persuade him to speak of them in detail. He was taken with other prisoners from Macon to Charleston to escape recapture by Sherman's Army, and at Charleston he was, with other officers, moved and confined in the city jail, exposed to the fire of the Federal batteries who were shelling the city. This treatment of the Federal officers was given in resentment for the bombardment. Owing to close confinement and poor food his sturdy physique here at last broke down. When he was paroled in 1865 he weighed 79 pounds; but good care, good food and a promotion to the first lieutenancy soon made him eager for more fighting. As soon as he was exchanged he joined his regiment in the field in time to take part in the battle of Five Forks; and in all of Grant's operations which led up to the final surrender of Lee at Appommattox. "For gallant and meritorious services" he was made Captain of Cavalry. For a considerable time he was stationed at Tazewell Court House, Va., acting as Provost Marshal for that district. His service in the army ended in November, 1865.

Immediately after leaving the army he went West and had a variety of experiences; hydraulic mining in Montana, keeping a gentile hotel in Salt Lake City, and being a sub-contractor in the construction of the Union Pacific Railroad. He began his newspaper work in New York on the *Wall Street Daily Indicator*, now known as the *Wall Street Journal*, and later was with *Bradstreets*.

His nearly four years of trial in war and 19 years of ups and downs, prosperity and adversity in varied undertakings, developed a character of which unfaltering courage was the basis. He quickly recognized and cheerfully met success or defeat. He had a talent which might be called applied courage when he came to the *Railroad Gazette* in 1884, and he had a knowledge of men which



James H. Bailey

stood him in good stead in his work here. He soon became vice-president of the corporation, and chose for his special work the duty of "the outside man," as he always liked to define it. This never meant that he was not an integral part of the management; for his initiation, suggestion and knowledge of the views of the customers of the *Railroad Gazette* made him invaluable. His niche is among the four or five able men whose work is a vital part of the development of the *Railroad Gazette* during the past 48 years.

Bailey's best known title, Colonel, is one conferred on him by his friends many years ago. He objected to it. He loved the commission so hardly earned in real war, but it became tiresome to continually correct those who so addressed him, and he gave up fighting against it, as he had long accustomed himself to give up cheerfully when he was fairly beaten; and, after all, a commission which might have been signed by thousands of friends means everything, and is the one to be held most dear.

W. H. B.

Handling Compound Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The paper of Mr. Beardsley, read at the recent meeting of the Traveling Engineers' Association at Chicago* deserves some critical consideration since the author makes statements also made by Mr. McCarroll some time ago.† Mr. Beardsley also makes some statements that will bear looking into before being taken as final. I do not agree with Mr. Beardsley that the simple engine will pull half its rating more economically than will the compound, for with proper use of the throttle the compound can be made to operate as satisfactorily as any engine; at least that has been my experience. No one but a blankety blank idiot would think of starting any engine with a train with the lever other than in the full-stroke position. No doubt the use of the starting-valve of the Vauclain compound is often abused; but does anyone know of an engineman who will not work the starting-valve for all it is worth, rather than have to double a hill? I have known of a number of cases of broken piston rods on the Vauclain, and it was invariably the low-pressure rod that broke, but as was pointed out by a writer in *Power* some time ago, this fault was remedied by a judicious selection of a proper material for these rods.

If, as Mr. Beardsley says, it is best to work a little steam going down hill, I would suggest that hand oiling of the valves and cylinders be practiced, and the oil pipes used to supply what little steam is required.

Of course, no engine should be slipped, and I found the Vauclain would slip worse than a simple, but that was due to faulty design and low adhesion, rather than to the compound feature. I cannot see any reason for making the reciprocating parts any heavier on the compound than on the simple of the same cylinder effort.

Speaking of blows and lameness in the Vauclain, I have seen some of the earlier engines puzzle a great many with lameness. One in particular that I recall had to be taken off the road, and was used as a switcher. Finally the defect was found in the relief valve of the main valve, the cage of which was broken. Putting in a new valve cured it at once. I should consider it a useless expense to examine the packing rings of a compound every three or four months. They will tell you when they need attention.

I can see no reason why the piston valve will carry the water over any quicker than will the D valve. This senseless prate about piston valves is getting monotonous. Some people look on the piston valve as a spooky, mysterious creation that needs the attention given a baby. It is all rot. The trouble with most of the piston valves is in the fact that the packing rings are made too tight and stiff, and such being the case they will wear the bushings fast. Some of the prominent stationary engine builders have used the piston valve for a decade past, even on engines which regulate closely, some of them using the shaft governor, which requires easy-working valves for its successful operation. One road I worked for made a practice of putting scale solvent in all boilers after washing, and for a few trips thereafter scale solvent was the popular color for striping stacks and front ends. At that time no one ever thought of charging this to the piston valve, though possibly (!) it was the offender; but these engines continued to run just the same.

Mr. Beardsley speaks of a test that satisfied him that the Vauclain would do more work on a grade than a simple engine of the same tractive power. Such tests are worthless without indicator diagrams to show just what both engines were doing. As to the more uniform crank effort of the Vauclain engine, I do not agree either with him or Mr. McCarroll. A study of the diagrams of the Vauclain found in the *Railroad Gazette* of May 29, 1903, will show that this is not so. Some years ago I took the trouble to make a valve-motion model, and later when running a Vauclain, added a model of the Vauclain valve and steam ports. By studying the action of this valve I can find no more uniform crank effort than that produced by the D valve of the simple engine. The diagrams mentioned show that both exhausts, high and low-pressure, take place simultaneously no matter what the cut-off, which means that both pistons have stopped doing business in that direction. The model shows that at one-half stroke, cut-off takes place at the same time in both cylinders; at seven-eighths stroke the high-pressure begins exhausting into the valve; while at the completion of the stroke the high-pressure, through the valve, is in communication with the low-pressure, the lead being equal for both cylinders. At seven-eighths stroke the exhaust port to atmosphere opens and compression begins in the opposite end of the low-pressure cylinder simultaneously with the beginning of the high-pressure exhaust into the valve, and any leakage in the low-pressure exhaust rings permits the high-pressure exhaust to pass to the atmosphere. One feature in favor of the Vauclain is that at very short cut-off the exhaust ports both from high to low, and from low to atmosphere have a full opening, while with the D valve a full opening is not available for the passage of the exhaust.

From the foregoing I fail to see how a more uniform crank effort is obtained with the Vauclain unless the wider exhaust opening helps the Vauclain; but to counteract this is the receiver, or exhaust pressure on the high-pressure piston. With the D valve with negative inside lap, compression begins as late in the stroke as it does with the Vauclain. I do not wish to give the impression that I am an anti-compound man. All I want is to show it as it is, giving the simple all that is due it.

I should like to add a few "Dont's."

Don't carry too much water in any boiler or work too much throttle on any engine.

Don't think a simple engine needs more slack than a compound, or needs to do the "slipper act."

Don't start any engine except in full stroke, or forget that water collects in the cylinders of all types.

J. V. N. CHENEY.

Railroad Gazette, Sept. 18, 1903, p. 664.
†*Railroad Gazette*, Sept. 26, 1902, p. 738.

Loadings for Railroad Bridges.*

Henry W. Hodge.—The constantly increasing weights of rolling stock on railroads is a subject which affects most vitally the safety of all bridges on such roads; and, as few operating departments have made proper allowance for such increase in ordering these structures, it has been necessary to remove many good bridges and replace them with heavier ones within very short periods; generally much shorter than their natural life, under loads for which they were designed. It is properly the field of the operating department to keep the probable increase in loads, in view when giving data to the construction departments; but though these live loads have been increased more than 100 per cent. in the last 20 years, with no signs of a maximum limit, few operating managers think there is the slightest necessity of designing bridges for greater loads than the latest locomotives ordered. I have known railroads to order bridges on the same line for three different live loads within two years, so that the first bridges were overstrained 33⅓ per cent. within two years after they were completed.

This is a short-sighted policy, and yet it is a question whether the bridge engineer is in a position to correct it, as his situation places him in the delicate position of appearing to wish to increase his remuneration if he suggests increasing the weight of a structure over what he is ordered to design. It is certainly advisable for railroad officers to give the subject more attention than it has heretofore received. The tendency is constantly toward the moving of freight in larger units. The extremely low cost per ton of moving freight on American railroads has been reached by the use of larger units than are used elsewhere.

Increased economy would be further secured by enlarging the loads carried by each locomotive, and, therefore, the final maximum weight of locomotive will only be found when the sustaining power of the roadbed is reached, or when it is impracticable to get more weight on the drivers of locomotives. The statement is often made that locomotives cannot be made much heavier because the rails will not carry more, but this statement has been made continually for many years, and, all the time, the weights of locomotives have been steadily increasing and the weights of rails have been increasing about proportionately. The section of rails can never be a bar to increasing live loads, as these rail sections can be increased to whatever point is desired. A much more serious difficulty to be overcome is the supporting power of the earth roadway and the rail joints. Ties cannot be spaced much, if any, closer than they are now, if bedded in the present manner in ballast, as the present spaces are about as small as possible to allow of proper tamping of ballast to hold the track in line and surface. If more bearing surface, with the present general arrangement, is desired, it will have to be gained by lengthening the ties, and there seem to be good reasons why this should be done.

With the present arrangement of ties, bedded in good stone ballast, the pressure on the earth roadbed, from driving axles with a load of 60,000 lbs., spaced 5 ft. from center to center, can be assumed to be spread evenly over an area of 5 ft. x 10 ft., or 50 sq. ft., giving a pressure of 1,200 lbs. per sq. ft. If this is doubled, for impact, there would still be only a little more than a ton to a square foot, which does not seem to be as much as a well-compacted earth roadbed should stand. Of course, this absolute pressure is not entirely the governing feature in the permanency of way, as it is necessary to have the ties held in place so rigidly that they will not get out of line and surface. But it must be borne in mind that the maximum loads hauled will be heavy freight trains at a comparatively slow-speed, and, in all probability, they do not have nearly as injurious an effect on the permanent way as the much lighter passenger loads moving at greater speeds. Thus, there is no reason why the maximum live loads should be determined by the supporting power, or the rigidity, of the permanent way.

There still remains the question of what maximum weight it is mechanically possible to put over a driving axle, and this will be the governing point of the extreme axle loads. Locomotive builders have had their ingenuity taxed already to get the necessary weight on the driving axles to prevent slipping, and yet keep within the clearance height. The height and width of the locomotive is practically limited, and, as the present distances from center to center of drivers are made such that these wheels are as close together as possible, there seems to be no further space to get in more weight, unless the railroad clearances are changed, and this would mean practically rebuilding the railroads. It may yet be possible to decrease somewhat the size of the driving wheels and thus give more height above the axles for additional weight, but the modern heavy freight engines have wheels less than 5 ft. in diameter, so that there is not much room for any considerable change in this direction.

Opinions from expert mechanical engineers engaged in the design of locomotives, seem to indicate that the final maximum axle loads cannot practically be increased more than 15 per cent. above the present maximum axle loads. This is a fair limit.

The locomotives built for the Atchison, Topeka & Santa Fé weigh, without tender, 232,000 lbs. on five driving axles, and 27,800 lbs. on the truck, making 232,000 lbs. on a driving-wheel base of 20 ft., or 259,800 lbs. on a total wheel base of 28 ft. 11 in. Some locomotives built for the Pittsburg, Bessemer & Lake Erie weigh 225,200 lbs. on four driving axles, and 25,100 lbs. on the truck, making 225,200 lbs. on a driving-wheel base of 15 ft. 7 in., or 250,300 lbs. on a total wheel base of 24 ft. 4 in. The latter engine is the heavier per linear foot, and the heaviest single driving axle carries 59,200 lbs., with an average for each driving axle of 56,300 lbs. If 15 per cent. be added to this average the result would be 64,745 lbs. per axle, and, from this, the writer is of the opinion that a locomotive having four driving-axle loads of 65,000 lbs. each will be sufficient to cover the extreme probabilities of rolling loads. The tender of this Pittsburg, Bessemer & Lake Erie locomotive has 35,275 lbs. on each of four axles, and increasing these by 15 per cent. gives 40,566 lbs.; but there are greater possibilities of increasing tender loads than there are for driving loads, therefore the maximum tender wheel loads should be set at 42,000 lbs. per axle. If one forward truck axle is used, taking 32,000 lbs., the result will be an engine weighing 292,000 lbs., followed by a tender weighing 168,000 lbs., making a total of 460,000 lbs., complete. The spacing of wheel centers for this theoretical maximum load, now generally used in bridge specifications, seem to be about correct, except the distance from the last engine driver to the first tender wheel, which is now generally 8 or 9 ft., and which probably should be increased to 14 or 15 ft.

The following uniform load still remains to be determined, and the heaviest loaded steel cars that the writer has been able to find are the ore cars, in use on the Algoma Central Railroad, which weigh 44,000 lbs., carrying a net load of 100,000 lbs., making a total load of 144,000 lbs. in an over-all length of 24 ft., thus giving 6,000 lbs. per linear foot. If this again be increased by 15 per cent. the result is 6,900 lbs., say 7,000 lbs. per linear foot. Therefore it will be safe to use, as the probable maximum live loads for present railroad clearance dimensions, two locomotives, weighing 260,000 lbs. on drivers, and 460,000 lbs. complete, with tender, followed by a uniform load of 7,000 lbs. per linear foot. It is not necessary or advisable for all railroads to adopt any such maximum loads as few roads will ever need such an extremely heavy class of rolling stock, but this suggested maximum load is only intended to apply to such roads as have very heavy grades, and are looking forward to hauling eventually the great est possible units over such grades. It certainly is not, and never will be, practical to adapt any particular set of live loads to the many railroad systems operating entirely different classes of traffic, under entirely different conditions.

J. W. Schaub.—The loading known as E-50, in Cooper's specifications, is now commonly used as a standard loading for railroad bridges. This provides for two engines weighing 355,000 lbs. each, including the tender, in working order. Bridges, if properly designed for this loading, will be able to carry with perfect safety a load fully 50 per cent. heavier than provided for. This means that the weight of engines can approach a total of 275 tons, before it would be necessary to even consider the renewal of the present bridges. When this loading has been reached, the present form of roadbed will long have disappeared. If engineers can feel assured that steel bridges, as now designed, will carry any load that the present form of roadbed will be able to bring to them, that is all that should be expected of them. Between the roadbed and the bridges, the bridges have the advantage just now, and the E-50 loading is more than ample to carry anything that can be carried on the present form of roadbed.

Theodore Cooper.—That the loads on freight cars, or the weights of engines, will continue to increase per running foot of track to an unknown or indefinite extent is, in my opinion, a most erroneous assumption. Excepting special lines of road, carrying one kind of freight between definite terminal points, as certain mine, quarry or ore roads, the interchange of traffic between the numerous lines composing the railroad system of the American Continent demands that all cars shall be able to pass freely over each line, without surpassing the limiting clearances, which determine the limiting cross-section of the train, including engines and cars. While some roads have cars in use locally which would not be accepted on other roads, it is very certain that the great interchange of freight will ultimately compel the adoption of standard cars which can pass freely over all lines.

The American Railway Association has recently adopted a standard box-car, which, presumably, is as large as would be acceptable to all roads. It has the following inside dimensions: 8 ft. high, 8 ft. 6 in. wide, and 36 ft. long. The inside cross-section of this car, 68 sq. ft., when reduced to the length of track covered, distance between bumpers, gives about 65 sq. ft. as the maximum storage capacity per linear foot of track. This car could be completely filled with any kind of freight, excepting minerals and metals, without exceeding 4,000 lbs. of freight per linear foot of track. Practically, it would be impossible to fill this car completely. If we allow (as would appear liberal) 1,000 lbs. per foot of track for the weight of the car, the maximum load per foot for fully 90 per cent. of the freight handled on our roads could not exceed 5,000 lbs. Of the remaining 10 per cent. (excluding special ore-carrying lines) the larger proportion consisting of machinery, structural work, manufactured articles, etc., could not be stored within the limiting cross-section so as to exceed the above maximum. Such cars, with this maximum loading, would weigh 190,000 lbs., which, with four axles, would give 47,500 lbs. per axle, or, with six axles, 31,667 lbs. per axle. The self-dumping 100,000-lb. coal car has 36,500 lbs. per axle and 4,300 lbs. per foot of track.

As such loads on 33-in. wheels, when the wheels once become worn or roughened, would be far more trying to the track than the heavier driving-wheel loads, owing to the larger diameter and better care, it is certain that there must be a limit to such loads, as determined by longer experience.

Considering the small percentage of the freight which could be stored in the limiting cross-section so as to give greater loads per foot of track than 5,000 lbs., and the impossibility of keeping such cars in continuous circulation with full loads, except upon the specially excluded ore roads, their introduction on railroads generally is improbable. It would seem to be justifiable, therefore, to assume that there is a limit to the freight load per running foot of track, and that 5,000 lbs. covers the limitation, unless it is assumed that the existing railroads will increase their present clearances, a tremendous undertaking in time and money.

Engines, also, must be limited in size and weight by the limiting cross-section of the roads, if not by the permissible axle loads. With the limitation of the driving-wheel base, increased weight on the drivers demands more space for the greater boilers, cylinders, grate surface and running gear. In the *Railroad Gazette* of Oct. 27, 1899, there is a theoretical examination as to the heaviest engine which could be built, under certain assumptions and with the usually accepted road clearances. Whether the conclusions of that writer are exact or not, it is interesting and instructive as showing the influence of the allowed cross-section of a road upon the maximum possible engine, and indicates that, under present restrictions, we have about reached, in existing engines, the maximum possible. His maximum requires five coupled driving axles with a fixed wheel-base.

For further increase in the weight and power of the motor, we must either look forward to the possibility of electricity or to a series of combined motors with articulated wheel-bases. The Baltimore & Ohio has now under construction an engine with 285,000 lbs. on six driving axles with an articulated wheel-base, the three forward and three rear drivers each having an individual wheel-base of 10 ft. and a total wheel-base of 30 ft. 6 in. Such an engine, however, would not produce any greater stresses on bridges than the typical consolidation engines with the same load per axle.

Maintenance-of-way conditions, weights on axles and car wheels, and existing clearances, all indicate that we are at or close to the maximum train loadings, under the present construction and limitations of our railroads. On Oct. 9, 1899, the writer recommended the adoption of his train loading E-50, by one of our important roads, as being, in his opinion, sufficient to cover all future load developments, when combined with the conservative unit strains now in general use; strains, which in the past have been very greatly exceeded, on nearly all roads, without risk or detriment, by the heretofore constantly increasing loads imposed. It is not apparent, at present, why this opinion should be revised.

*Extracts from a discussion at the June convention of the American Society of Civil Engineers, reprinted from the August Proceedings, pp. 684-689, and September Proceedings, pp. 861-818.

Yellow Fever in Texas.

Many items appearing in Texas newspapers indicate that there has been a yellow fever scare at San Antonio, and perhaps at other places in that State, but as most of the newsgatherers are under evident local restraint in giving the facts, it is uncertain to what extent business and traffic have been affected. In one case a through passenger train was taken off and there has been some delay in the movement of freight by reason of a great number of local quarantines imposed by cities and towns of all sizes and in all directions, in their endeavor to guard against infection from the alleged dangerous point. Some of the general passenger agents have had their time filled up with the work of issuing to their agents and conductors the numerous quarantine notices which have been sent to them by municipal officers. In the matter of disinfecting merchandise the railroads appear to be fully aware that, since the discoveries made at Havana, showing conclusively that yellow fever germs are generally and probably exclusively transmitted by mosquitoes, the time-honored requirements in the way of fumigation are unnecessary; and they appear to be acting accordingly. A reporter in the *Houston Chronicle* says:

"The Southern Pacific, International & Great Northern, Missouri, Kansas & Texas, San Antonio & Aransas Pass and Houston & Texas Central have been handling freight from San Antonio ever since October 23 without reference to the quarantine regulations. Circulars notifying agents to accept freight out of San Antonio subject to delay have been cancelled and freight is moving as usual.

"The railroads consult the various towns along their lines as to whether they will receive freight from San Antonio or not. If the cities agree to receive it, it is handled independent of the quarantine restrictions. It is fumigated, however, as a matter of allaying fear. What this process of fumigation consists of is not known, but the general supposition is that a little disinfectant is squirted on the side of a box car which answers for the entire train.

"The railroads comply with this fumigation restriction without a murmur, but smile at the idea of fumigating freight and freight cars when it has been demonstrated so positively that the mosquito is the propagator of the disease and that it cannot be carried from place to place in any other way. A little sulphur burned on the pilot of the engine is just as effective as dipping the entire

train in a huge vat of formaldehyde. It is more than likely that the fumigating process delays a whole freight train about 10 or 15 minutes. . . . The Southern Pacific passenger department to-day announces the resumption of train service between Victoria and Cuero on the New York, Texas & Mexican, which was suspended day before yesterday on account of the quarantine of Victoria against DeWitt County. The lines are being loosened all over the State and the present restrictions practically amount to no quarantine at all, and about the only thing it amounts to is to keep a lot of quarantine guards at work."

A Heavy Girder Rail for City Streets.

The Pennsylvania Steel Co. has one of its mills running on an order of 3,500 tons of a special 9 in. girder rail weighing 141 lbs. per yard. The section of this rail is shown in the accompanying engraving, Fig. 1. It is to be laid in Philadelphia in a three-track line along Delaware avenue between Vine and South streets. These tracks are used jointly by the Pennsylvania, the Philadelphia & Reading and the Belt Line Railroad, and serve the many wharves and warehouses along the water front. The traffic is exclusively freight and is moved at slow speed.

The method of laying the rail and pavement is shown in Fig. 2. A bed of concrete, 6 in. thick is laid on the sub-grade of the street, and on this is a layer of sand 10 in. thick in which the ties are bedded with 1½ in. of sand above and below. The granite paving stones, 8 in. thick, are laid on the sand and grouted with tar and gravel. The ties are 7 in. thick by 9 in. wide and 8 ft. 6 in. long, and the rails are laid on them with 6 in. x 11 in. tie plates, $^{15}/_{16}$ in. thick. Tie rods are spaced 5 ft. 6 in. apart, giving six rods to each rail length of 33 ft. Twelve 1 in. bolts are used in each joint, arranged in two rows of three each on each side of the joint. The splice bars are 2 ft. 8 in. long and of the section shown in Fig. 1.

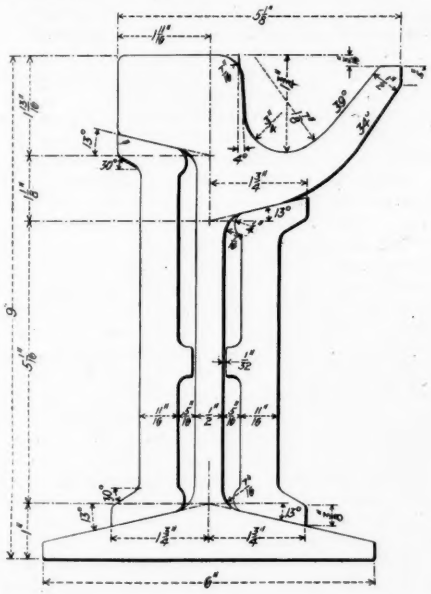


Fig 1.—Section of 141 lb. Girder Rail and Splice Bars.

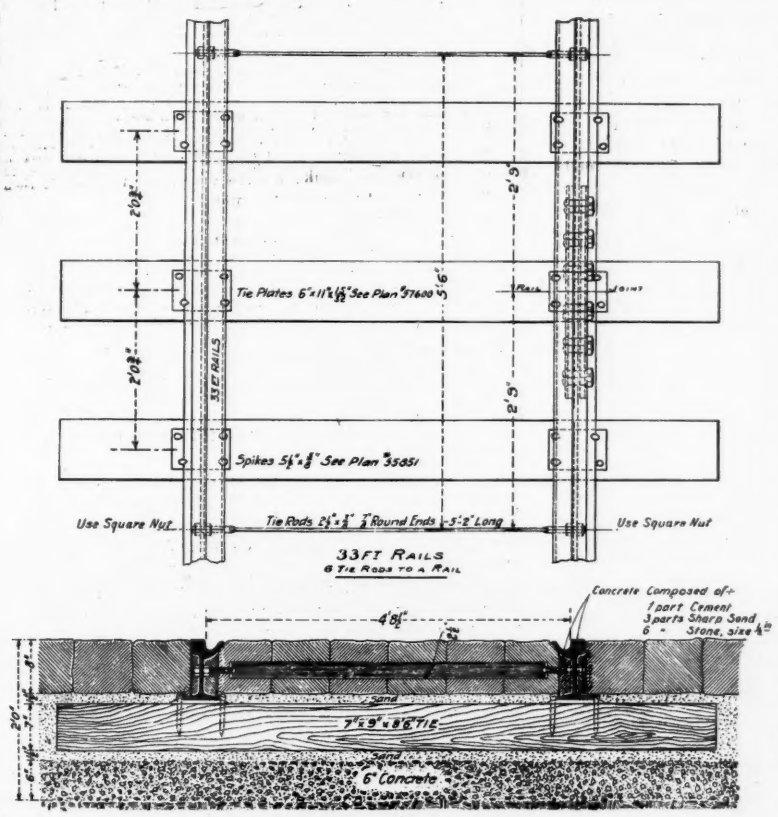

Tie Plates 6"x11"x15/16" See Plan 37600
Spikes 5½"x⅞" See Plan 35851
Use Square Nut
Tie Rods 2½"x¾" Round Ends 5'-2" Long
Use Square Nut
33FT RAILS
6 TIE RODS TO A RAIL
Concrete Composed of 1 part Cement 3 parts Sharp Sand 6 " Stone, size ½"
4'8½"
Sand
7"x 9"x 8'6" TIE
Sand
6" Concrete

Fig. 2.—Track Construction for Paved Street.

Prevention of Contagion in Passenger Cars.

BY LEROY M. YALE, M.D.

Recent articles in the newspapers concerning the embargo of a southwestern town against railroad communication on account of fear of yellow fever, and also various articles about the unsanitary condition of public conveyances, and especially sleeping cars, make it worth while to consider what are the facts as regards the communicability of the commoner contagious diseases by such methods. The general question of the exclusion of all cases of contagious diseases from public conveyances is not here considered, as the conditions of personal contagion are the same in a public conveyance as elsewhere; that is, you will catch it just the same as you would in a house; but the question of contagion remaining in the car after the departure of the contagious case is what we have to consider. The mode of communication of contagious diseases varies very much, inasmuch as, in particular, the poison of some diseases clings to material substances for a greater or less time, while that of other diseases clings little, if at all.

We may begin with the yellow fever, as that is the disease which has excited this particular disturbance of railroad traffic. So far as is known at the present time, this disease is only communicated through the agency of mosquitoes (in this case the *Stegomyia Fasciata*); the organism which causes the fever being partially developed in a mosquito and completing its development within the human body. If this scientific belief is correct, it is obvious that the disease could not be carried by a train unless that train carried a patient already sick of the disease, or carried infected mosquitoes, which had obtained the infection from cases elsewhere. In case of a suspicion of danger from yellow fever, the natural and proper protection of a community would come from the isolation and watching of the case and the guarding of that case most carefully from attacks of mosquitoes, which might, if infected from it, carry the disease elsewhere. The ordinary proper sanitary care in use in all contagious diseases should also be employed; but, so far as the railroad itself is concerned, beyond the duty of not knowingly carrying people affected with this disease and a reasonable endeavor to keep mosquitoes from riding free, we cannot see that the road has any further responsibility in the case.

A very similar condition exists in regard to malarial fevers. As until recently these were not known to be contagious the public anxiety about them is nil. These diseases also are transmitted, so far as is known, only through the agency of mosquitoes, but mosquitoes of another species (*Anopheles Maculipenis*, and probably other species of the same genus); and the precautions to be taken against them are precisely the same as those spoken of for yellow fever. There was an old idea that malarial fevers followed railroads, which seems to have been based upon very general, if crude, observations. The reason of it, doubtless, is that the building of roadbeds favors the formation of shallow puddles of water which are essential for the breeding of this kind of mosquitoes, which communicate the malarial poison. Cases of the spread of malarial fever along the route of an old established railroad probably are explicable merely through the easy transit of people already affected by the disease. Thus in 1867 there was a remarkable prevalence of malaria along the line between New York and Bridgeport, even in places where malarial diseases had been previously unknown.

Another disease which has caused the greatest alarm, and the fear of which has imposed exceeding hardship on travelers, is cholera. This is now known to depend upon the introduction into the system of an organism known as the cholera bacillus, sometimes called, from its shape, the comma bacillus. And there is no doubt that in all time it has traveled about as fast as the ordinary modes of progression. Anciently it was attributed to the Wandering Jew, for it went about as fast as a man could walk. Now, it is supposed to be spread by railroads, vessels, and the like. It certainly is spread by travelers if precautions are not taken to prevent infection, but it is not caught by contact. Practically, it is always taken through the introduction into the digestive tract of infected food; or, much more frequently, infected drinking water. As the poison multiplies very rapidly in the system and is discharged from the body in much greater quantity, if the discharges are not properly disinfected, the soil, the drinking water, and even utensils and food may be quickly infected, and the disease spread. But, so far as the railroad itself is concerned, if there is proper supervision over the supplies of food at eating stations, and in the cars, especially of the milk, and if all drinking vessels are kept scrupulously clean, by scalding and otherwise, and only water of undoubted purity be served to passengers, the carrier would seem to have performed all his duty to the public safety.

A disease of another nature but similar in methods of propagation is typhoid fever. This likewise depends upon a bacillus, known as the typhoid bacillus. This organism thrives in the soil, may live upon soiled articles, and preserves its vitality for a considerable length of time in water, as well as in milk and its products. The bacillus is found in great quantities in the dejections, and soiled bedding may be a source of infection; but it is scarcely credible that untidiness in such a degree as the using of bedding soiled by dejections could take place in any degree under ordinary management. Actually, in practice, the contagion of typhoid fever comes from food infected with the typhoid bacillus, but much more frequently from polluted water; and, as the bacillus is introduced into the system through the digestive tract, it would be in very exceptional instances that the person could procure the poison from his bedding; as, for instance, if a soiled sheet were sucked by a baby.

A disease now very rare in this country, sometimes confused with typhoid in popular ideas, is typhus fever. This poison is communicated largely from the breath and from the skin. It is quickly absorbed by bedding, and also by furniture, upholstery, and the like, especially that of a dark color. If such a disease were prevalent in any degree in the country at any time, it would then be incumbent upon the railroad to exercise special supervision; but, inasmuch as typhus is a disease associated with the hardships of life, as its synonyms, ship fever, jail fever, and camp fever, show, it is not to be looked for often in the class of community that would ride in sleeping cars. In the last epidemic in New York that the writer can recall, the cases were found chiefly in tramp lodging-houses. If the disease were spread at all by railroads it would be more likely to be through the agency of the emigrant car than the Pullman.

There is a group of very contagious diseases, of which may be mentioned measles, whooping-cough, and perhaps influenza, concerning which we have very little information as regards the clinging of their poisons to materials. In the present state of our knowledge there is no duty incumbent upon railroad managers beyond a reasonable attempt to exclude sick persons from their cars.

A question which is agitating the people now because it is new, is the communicability of tuberculosis, and as lines going to and from health resorts necessarily carry many people infected with this disease, considerable popular alarm results. The infection of tuberculosis, so far as we know, usually comes through two avenues; the digestive tract and the respiratory organs; the tuberculosis bacillus being the organism which causes the disease. The infection by ingestion, or swallowing, is of extreme rarity except in the very young. It would be possible if a child sucked an infected blanket; but in all ages, and especially in young adults, the ordinary method of infection is through the respiratory organs. It is necessary that the sputum containing the organisms should have become dried and pulverized sufficiently to be borne in the air. Hence the danger of expectorating upon the ground. While it is true that this is very dangerous only to those especially predisposed to this poison, it can easily be seen that in a filthy car where passengers were allowed to expectorate upon the floor, and the car not too carefully cleaned, the dust from such dry sputa might be dangerous to those who were especially susceptible or already suffering from lung troubles of any sort. With the amount of information that is now general among the class who sleep in sleeping cars, it is not likely that bedding would be allowed to become soiled, but it is nevertheless incumbent upon railroads who are likely to carry many cases of tuberculosis to have a very special attention paid to all bedding, to the extra airing of berths and the frequent beating and sunning of the blankets.

We now come to a group of diseases the contagious principles of which are notable for the pertinacity with which they cling to materials, and the first of these is smallpox. The poison of this disease will cling to and is easily carried by bedding, drapery, furniture, and stuffs and materials of all sorts, including the clothing of third persons, the hair of an attendant, and what not. Smallpox has of recent years become a rare disorder, except among the poor and ignorant and uncleanly classes; but in some regions, and at all times when an epidemic is known to exist, great watchfulness should be exercised, and if any case is known or believed to have been in a car, that car should be thoroughly disinfected by heat, boiling heat or steam when possible, or with the best known disinfectant, such as formalin, before it is again used. Fortunately the public dread of smallpox is sufficiently great to compel, through public opinion, the exercise of pretty strict sanitation when this disease is in question.

Another disease quite as contagious but not as grave, and communicated in precisely the same way, is chicken pox. Owing to the slight gravity of the disease it is difficult to secure the support of public opinion in carry-

ing out any severe sanitation against it. Diphtheria, one of the most dreaded of diseases, depends upon the presence of the well-known diphtheria bacillus. This poison clings so that the disease is not only communicated by personal contact but also, in many well established instances, from bedding, articles which have been about the patient, toys, dolls, and all such things. It is spread, too, by milk and other modes of contagion which have no special bearing upon transportation. In view of the frequency with which this disease is communicated by contaminated articles, any part of a car or any bed, in which a person known to be suffering from diphtheria, or from any other disease of the throat, has been, should be thoroughly disinfected. The writer knows of a person who has had repeated attacks of sore throat after a night's journey in a well-known line of steamboats. They were probably all diphtheritic. The only one in which a culture was made was certainly such. The presumption is that the diphtheritic contagion was in the staterooms of the boats.

Another disease of this group is scarlet fever. This disease is carried by articles and for a long time, not only bedding and the articles so often mentioned, but linen which has been at the laundry at the same time as infected bedding may be the source of contagion. Articles put away may retain them for months, and instances are numerous and well authenticated where the contagious principle has endured for a surprising length of time. It seems to be especially in connection with the shed skin that the poison adheres, but this is certainly not the only way, as is proved by many cases. One of the great difficulties in the way of the enforcement of sanitation is due to the popular misconception of the scientific name scarlatina, which is taken for the diminutive of scarlet fever and to signify a mitigated type, which is not at all true. It is merely the scientific name of the disease. Under this impression and because mild cases do not seem ill, they are often sent to school or allowed to travel when in a condition to give the disease to other persons very easily. Physicians familiar with the disorder rarely think a case safe under six weeks. They are often returned to school, where the Board of Health is not very diligent, in two or three weeks, if the case has been mild, under the presumption that the danger to other persons is correspondingly slight, which is not true. Milk again must be mentioned as a conveyer of contagion, and this article is frequently mentioned in this connection because of its being so often served at the railroad stations as a form of refreshment.

The Railway Signal Association.

The Railway Signaling Club, at its annual meeting in Detroit, last week Tuesday and Wednesday, voted to change its name to that shown in the foregoing title. The President and other members had found that railroad officers and others not intimately acquainted with the organization looked upon it as one of only local influence, and the new name was adopted with a view to dissipating this idea.

The first session was opened Tuesday afternoon by President H. C. Hope (C., St. P., M. & O.), and the number of members in attendance was about 70.

The report of the Secretary showed a large increase in membership, about 200 having joined during the year. The Treasurer's report showed receipts of $450. Fourteen new members were elected. The first business was the reading of the report of the committee on distant signals, which was printed in the *Railroad Gazette* of November 6, page 792. A number of members wanted to have the committee lay down specific distances for different kinds of signals; a maximum distance at which wire operated signals could be worked; a maximum distance at which pipe connected signals could be worked; and the minimum distance at which a power operated signal would be required. This proposition was not, however, received with favor, as no one seemed willing to lay down any rule or rules which would be generally applicable. The demand for prescribed distances ostensibly arose from a desire to have an authoritative declaration to which an individual signal engineer could refer in defense of his action in specific cases; but the discussion brought out the fact that in many cases a signal engineer would probably find an association standard an embarrassment; for if his practice were different from that of the association his difficulty in justifying it would be increased. There was also a demand that the committee should continue its work and define what is a proper and efficient power distant signal. To this it was replied that the state of the art was not yet sufficiently advanced to warrant the association in endeavoring to set up a standard in this matter. The association finally voted, 28 to 4, to accept the committee's report as one of progress, and the committee was continued, with the expectation that it would further discuss the subject of distances for the different kinds of signals.

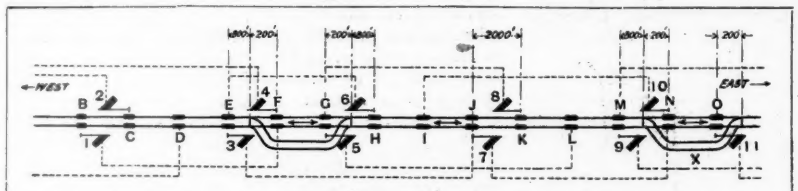
The clause in the committee's report, as published, to the effect that a distant signal at an interlocking plant cannot be worked automatically with success, was explained to mean that the committee thought the term "automatic" improperly used in connection with such a signal. The signal, even if actuated by the relay of a track circuit, should always be so controlled that the tower man can at any time put the arm into the horizontal position; and this, of course, destroys or impairs the automatic feature.

AUTOMATIC SIGNALS FOR SINGLE TRACK.

The next business was the report of the committee on this subject, Messrs. C. H. Morrison, A. H. Rudd, J. E. Gillmor, W. L. Dryden and A. H. Rice. The substance of the report follows.

Your committee have, after due consideration, deemed it advisable not to recommend the use of automatic signals on a single track railroad. If automatic signals are used, they should be considered merely as an adjunct to the telegraph block system. Under many conditions (but always as an additional safeguard—an adjunct to the telegraph block signals) what may be termed isolated automatic blocks could be put in to further protect switches, stations, curves or grades, which may be so badly located that approaching engineers do not have a good view. If a block system is to be installed on single track the electrically controlled Manual Block System or the Staff System should be used.

The accompanying sketch is submitted as a suggestion as to how automatic signals should be located with regard to sidings, should it be desired to install automatic blocks on single track.



Suggested Arrangement of Automatic Block Signals on a Single-Track Railroad.

In the sketch signal No. 10 is controlled by the track circuit to I. If two trains were ordered to meet at siding X, and the east bound train passed L it would throw signal No. 10 to the stop position and hold the west bound train 200 ft. back of the east bound facing switch. This would then allow the east bound train to proceed to signal No. 9, which is located 800 ft. west of the switch; the east bound train would then flag itself to the switch. If, however, the west bound train should pass signal No. 10 before the east bound train passed I, it would throw Signal No. 7 to the stop position and it could proceed to signal No. 8, holding the east bound train at signal No. 7. The west bound train would then back into the siding and allow the east bound train to pass.

The distance between opposing signals at switches should not be over 1,200 ft., while on the open road (or between stations) they should be as far apart as 2,000 ft. The object of staggering these signals is to keep opposing trains sufficiently far apart to avoid the possibility of an engineer who over-runs a signal running into the head end of the opposing train.

It appears to be quite generally agreed that for a block system to protect opposing trains it is necessary to provide both the human attendant and the simplest electrical apparatus. It will be admitted that the electrical apparatus used in "controlled manual" systems (including the electric staff system) is simpler than that used with automatic track circuit systems.

It may be claimed that the use of automatic signals on single track facilitates the movement of traffic; but the opinion of the committee is that it retards rather than facilitates it. If opposing trains are to be governed by the indications of the automatic signals, they will, when approaching meeting points, be running "under control" or at cautionary speed for considerable distances. This wastes time and is likely to induce among engineers a lack of respect for signals. This cautionary running cannot be reduced except by making the blocks very short; and, with the high speeds now customary everywhere, very short blocks are undesirable.

This report was accepted without much discussion. The question was asked why the committee did not show starting signals for trains moving out of the side tracks, but it was replied that the indicator was expected to serve for this purpose; neither indicators nor distant signals are shown in the drawing. After the report had been accepted there was a desultory discussion on single-track automatic signaling. The view of the committee, that automatic signals are not useful or profitable on single track was controverted, the argument being that where the distances between meeting points are long, it is necessary to have intermediate automatics for protection against rear collisions. Such protection does facilitate traffic by permitting freight trains to run closer together. But it was asserted that on single track roads it is found usually that by reason of insufficient facilities at yards, it is not desirable to run two or more freight trains on the same schedule.

This ended the afternoon session. At the evening session the first report taken up was that on the

COST OF IRON AND COPPER WIRES FOR LINE CIRCUITS.

This report was printed in the *Railroad Gazette* of November 6, page 794. The discussion had to do chiefly with the economy of waterproof insulation. The principal defenders of the use of insulated wires were the members from the Lehigh Valley. That road has in use many hundred miles of insulated wires. The chief object in the use of insulation is the protection of the wires from crosses with telegraph or electric line wires, or others carrying powerful currents, which crosses would wrongfully clear a signal. For iron wire it was argued that weatherproof (not rubber) insulation is useful in preventing rust. If the insulation lasts five years the wire then is as good as new. Its life (bare) has been prolonged five years. In regard to insulated copper wire divergent views were brought out, but no one's experience appeared to have been sufficiently extensive to warrant satisfactory conclusions. A manufacturer spoke of making waterproof insulation to be guaranteed for from six to 18 months. This aroused the indignant protests of members who thought that insulation ought to last from five to ten years; but it was explained that the shorter period mentioned was the limit set by the ultra-conservative guarantor. The wire would probably be satisfactory for five years or more. As no one has used insulated wire many years, even the most friendly advocates of the practice were unwilling to give final opinions as to its value. A motion was made to take a letter ballot on the desirability of using insulated wire, but this was voted down on the ground that the great majority of the members had had too little experience to make their views valuable; and, finally, the report was accepted and the committee asked to make further inquiries as to the experience of members.

The remainder of the evening session was taken up with the report of the committee on Three-position signals, etc., which was printed in the *Railroad Gazette* of November 6, page 789. This report, prepared by Mr. Anthony, was so logical and conclusive that it elicited pronounced applause, but no discussion whatever. On motion of Mr. Elliott, seconded by Mr. Rosenberg, the report was accepted and the committee "highly complimented" on its work.

The first business on Wednesday morning was the reading of the report of the committee on signal circuits; Messrs. J. C. Mock, W. E. Foster, F. P. Patenall, L. R. Clausen and George Boyce. This committee presented a table showing the practice of certain roads, with the opinions of members reporting the practice, and a diagram showing the circuits of an automatic signal installation as approved by the majority of those voting. With this plan was a drawing showing proposed standard nomenclature and symbols. This report was heard by the members with much interest, but we do not reproduce it because the opinions and views are now several months old, and because of its fragmentary character. Only 13 members responded. Many prominent roads are not represented and the members who are represented did not express themselves fully on all the points which the questions deal with.

The information gathered is summarized by the committee, and from this part of the report we quote.

"Lightning Guards.—Here we find roads using what they do not believe in. This is an important part in the equipment of automatic block signals, but as yet we have found nothing that fills the requirements. Seven roads are using fuse wires and spark gap, but this does not receive any votes for the ideal system. Six use the choke coil and six use the combination of choke coil and spark gap and fuse wires. Four believe the choke coil and spark gap to be the best; five would add the fuse wires to the choke coil and spark gap. One road does not use any and one believes in not using any. Mr. Anthony, of the Pennsylvania, is of the opinion that they can be dispensed with if the main circuits are grounded.

"Switch Indicators.—One road believes in the bell as a switch indicator; none of the roads voting use it. Miniature signals are used on seven roads and 11 believe this to be the best. Three do not use indicators and one does not believe in them, although he qualifies his vote with notation, 'Used only in rare cases; as a rule none are used.'

"Switch Boxes.—Eight roads have switch boxes that shunt the track circuit and seven believe this method to be correct. Seven use the switch box that breaks and shunts the track circuit, but only one favors this for the ideal system. Three believe that the switch box should be arranged to open the signal circuits and five have this arrangement in use."

In the drawing showing features approved by the majority of those voting, the block sections are three-fourths mile long; there is a home and a distant arm on the same post; the signals are electric semaphores; normally clear; setting point at the signal; worked by storage battery charged from a power line; distant signal controlled by pole changer on home signal; choke coil and spark gap lightning guards; visual switch indicators; switch boxes arranged to shunt track circuits; cross over rails track circuited; stone ballast.

The committee deemed it impracticable to go into a thorough discussion of signal circuits, and therefore contented itself with laying down the following

General Principles.

"1. Make sure that the protection afforded as set forth in the instructions to trainmen has been provided in the arrangement of circuits.

"2. Locate batteries with respect to controlling and operating appliances so that a cross in the wires or a shunting or bad adjustment of a circuit controller will do the least harm. In most cases this will require that the battery be placed farthest from the instrument operated or beyond the last circuit controlling device, as a relay or a signal or switch circuit breaker.

"3. Avoid common wires, especially long ones and complicated multiple circuits. When practicable and the expense is not prohibitive, make each signal circuit and each indicator circuit a unit in itself. By this means chances for trouble are lessened and when it does come it is localized.

"4. Adjust the resistance of line wires and electro magnets for the greatest economy in battery consumption consistent with the service required and the exposure to which they are subjected; taking into consideration age and difference of temperatures of batteries as affecting their energy and of the line as affecting its resistance and mechanical strength.

"5. All instruments should have marked on them the resistance and minimum E. M. F. required at the terminals for reliable working; this in order to be able to see at a glance the efficiency.

"Any circuit plan should be sufficiently clear to be understood by those familiar with the art without explanation."

The report says further that "electric locking should provide for the obvious intention of such installations, namely: Preserving to a train the route once given to it until the train has passed through the limits of that route. Electric locking should be regarded as an integral part of an interlocking plant, and when it is out of order the plant should be put out of service. There are conditions, however, which demand an emergency release in order to avoid serious delays to traffic. There are two kinds of releases and sometimes both are used. The mechanical hand release is the one recommended by your committee where any is considered necessary, since it provides for certain precautionary actions on the part of the signalman before the electric locking can be nullified. The electric switch emergency release, by the manipulation of which the electric locking is put out of service either temporarily or permanently, depending upon the will or memory of the signalman, is not recommended."

The diagram shows a cross-over between main tracks equipped with track circuits distinct from the main track circuit and actuating a separate relay. Through the points of this relay run the circuits controlling the signals of that block section on both tracks.

The discussion of this report turned chiefly on the nomenclature and symbols. A few changes in the wording and in the drawings were informally agreed upon and the report was accepted as a report of progress, the committee being continued.

After the discussion of this report, the ordering of two new committees, and the election of officers, the meeting adjourned. The new committees are one on Records and Reports, to consider the question of uniform books, blanks and clerical standards in signal engineers' offices, and one on Definitions.

The officers elected are: President, J. C. Mock, Michigan Central, Detroit, Mich.; Vice-President, Lawrence Griffith, Grand Central Station, New York City; Secretary-Treasurer, B. B. Adams, *Railroad Gazette*, 83 Fulton street, New York; member of executive committee, L. R. Clausen, Chicago, Milwaukee & St. Paul.

In selecting a place for the next annual meeting two cities were named; Niagara Falls and St. Louis. The vote resulted in the choice of St. Louis by 28 votes to 13 for Niagara Falls. The date of the meeting was left to be fixed by the executive committee, the expectation being that it would probably be set in October, or earlier.

On Tuesday forenoon the members were entertained by the Michigan Central. Under the guidance of Superintendent Morford, Assistant Superintendent Adams and Signal Engineer Mock the association was taken by special train from Windsor to Woodslee, Ontario, where about 20 miles of the line has just been equipped with automatic block signals. These signals were made by the Union Switch & Signal Company, and the cross-over tracks have the separate track circuits as mentioned in the foregoing report. On Wednesday afternoon the members were entertained by the Olds Motor Company, of Detroit, at the factory where is made the "Oldsmobile." Here the members were shown a new gasoline motor inspection car which this company has just brought out.

Comparative Eye-Bar and Wire Cable Designs for a Highway Bridge Over the Rhine at Cologne.

The Harkort Company, which is one of the foremost bridge companies of Germany, has published an illustrated description of two proposed designs for a suspension bridge at Cologne. Alternative designs are described, which have been worked out in detail by the same company, one for an eye-bar cable and the other for a wire cable. The bridge consists of one main span 721.6 ft. long, and two side spans 360.8 ft. long, having one roadway between two trusses 39.4 ft. center to center, and two promenades or brackets outside of the trusses. The total width, centers of railings, is 55.8 ft.

The main carrying member of the suspension bridge can be made of a cable of parallel-laid wire or eye-bar links without affecting the external appearance of the structure to any extent. The wire cable has the advantage of great strength with correspondingly small weight, against which are the disadvantages of difficult erection and the inaccessibility of the wires for constant inspection. The cable proposed for this bridge by Felten & Guilleaume, the German wire makers, consists of 19 single ropes, which are woven in the shops and can be easily erected. The process of manufacture is such that they are protected perfectly against moisture and the formation of rust. The eye-bar cable has the advantage of being easily painted and inspected in all its parts, and the disadvantage of great weight. The larger volume of the eye-bars, as compared to the wire cable, with its dimensions almost vanishing to the eye, can hardly be considered a disadvantage and the erection of the bar cable is more simple. Both designs were worked out with equal care and impartiality.

Fig. 1 shows the general outlines of the bridge for either of the cables. The cable is anchored in the anchorages and fixed at the top of the towers, which are pivoted on roller bearings at about the level of the roadway. The stiffening trusses for the three spans are non-continuous, and their only connection with each other is by the cable at the tower tops. The cable forms the upper chord of the stiffening truss. The planes of the cables and trusses are vertical and parallel, and are 39.4 ft. centers. The lower wind bracing is placed below the pavement, and is non-continuous over the piers. It consists of a rigid quadruple system of diagonals, and to obtain the greatest possible lateral stiffness, it takes in the lattice girder and fascia of the promenade as its extreme chords. The arrangement of the upper wind bracing can be seen on the drawing. The towers are connected on top to the cables, and the steel work in them is encased so as to present, together with the stone piers, a uniform appearance.

The eye-bar cable will be made of eye-bars cut out of plates. A Siemens-Martin steel of 71,000 to 85,000 lbs. per sq. in. ultimate resistance, and 18 per cent. elongation, is intended to be used. Nickel-steel of 100,000 to 114,000 lbs. ultimate strength and 15 per cent. elongation was not considered because the price of nickel-steel was then very high. Generally the eye-bars are 15.8 in. x 1 in. Hollow cast or pressed steel pins of about 12 in. in diameter are to be used.

The wire cable is to be made by the patented process of Felten & Guilleaume. Each of the two cables consists of 19 patent-locked strands of 187,000 lbs. per sq. in. ultimate resistance and 2 to 3 per cent. elongation, with an elastic limit of 115,000 lbs. The greatest stress on the cable is 46,000 lbs. per sq. in. The spaces between the wires in the strands are filled with red lead, which is also used as a coating in the making of the strands. The

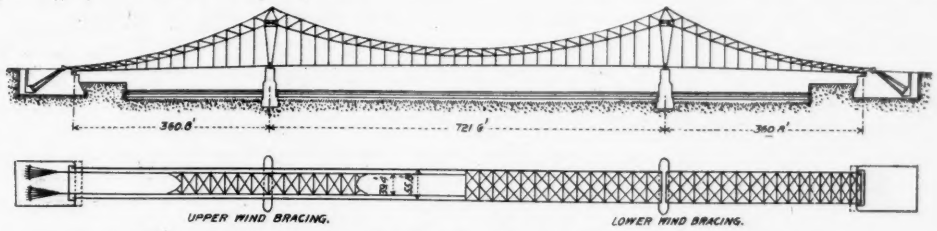


Fig. 1.—Plan and Elevation of Highway Suspension Bridge at Cologne.

strands in the cables are parallel to each other, and form the cross section shown in Fig. 2; in this form they are pressed and held by a wrapping of square wire. The spaces between the individual strands are filled by layers of fibrous stuff, soaked in red lead. At the panel points, where greater pressure will be exerted, the external spaces will be filled by metal fillers. The wrapping is a .2 in. square wire.

The attachment of the web members to the cable is an interesting detail. In this case not only vertical panel loads but web stresses have to be transferred to the cable, and the value of the truss depends on the efficiency of this connection. As the friction devices usually used were found to be unsatisfactory, a new friction detail was designed by the company and patented. Fig. 2 illustrates this connection. As can be seen from the drawings, two halves of a steel shell A are laid around the cables, which are pressed together by rings I, forced on projecting shoulders D. Attached to this shell are gusset plates C, and four angles F, which laced together form an open box column around the cable. This arrangement makes it possible to erect the stiffening truss without consideration of the cable, since the connection boxes are made tight afterwards, and it also distributes more or less, the forces tending to overcome the resistance of these boxes to sliding.

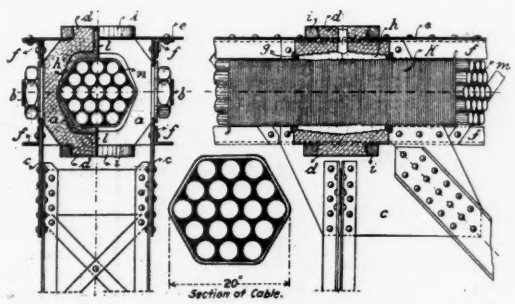


Fig. 2.—Detail of Attachment of Web Members to Cable

In the computation it is assumed that the cable carries the whole of the fixed load of the bridge, at normal temperature, and that the stiffening truss comes into action under live load and change of temperature.

For the wire cables an allowable unit stress of 48,300 lbs. per sq. in. was assumed, and for the eye-bars and stiffening trusses 19,200 lbs. per sq. in. The total estimated amount of steel is as follows:

	Eye-bar cable, lbs.	Wire cable, lbs.
Floor system and bracing.....	3,540,000	3,540,000
Towers, including housing.....	1,930,000	1,865,000
Eye-bar or wire cables.....	6,700,000	3,220,000
Stiffening trusses	2,420,000	2,610,000
Total	14,590,000	11,230,000

The cables in the Williamsburg bridge cost 15 cents per lb. in 1900, and the recent bids for the Blackwell's Island bridge were 8.03 cents for nickel steel eye-bars, 6.52 cents for structural steel eye-bars, and 5.64 cents for other structural steel. Estimating on these prices the cost of the two designs is about the same.

A train of the Great Central Railway of England now runs through each way daily between Manchester and Dover, without passing through London. The route from Manchester is by way of Nottingham, Banbury (Great Western), Oxford, Reading (South Eastern), Redhill, Tonbridge Junction and Ashford. The Great Central now runs trains between London and Sheffield, 164 miles, in three hours, and without a stop.

Staybolts.*

The greatest cause of broken staybolts is expansion and contraction of the fire-box sheets, and it therefore follows that fire-box design has a direct relation to staybolt breakage. This fact is generally ignored in designing new boilers. We scheme for larger grate area and increased heating surface; squabble over flue spacing and circulation, and then, when these and other elements satisfy us, stick in the staybolts at so many per square foot.

The long narrow fire-boxes, curving sharply outward to a broad crown-sheet were designed with little or no regard for effect on staybolts. Staybolts screwed into a comparatively thin sheet at an angle of say 75 deg. will soon give trouble. However, the latest wide fire-boxes eliminate all sharp curves in the side sheets, and consequently benefit the staybolts.

Since the relative difference in movement due to expansion between the outer and inner fire-box sheets remains constant regardless of the space in the leg of the fire-box, it follows that the wider apart the two sheets are, the less bending angle will be given the bolt, and consequently the greater number of vibrations may be had before breaking. I have seen in some boilers having a 7-in. water space at the crown-sheet line, and but 4 in. at the mud ring, practically no broken bolts above the horizontal central line of the box.

Staybolts break more frequently in bad-water districts than in those districts where the water is freer from incrustating solids. This is not to be attributed to the action of the water on the bolts, but to the fact that such engines are washed out very much more frequently, with consequent vibration of the bolts each time. There is apparently no remedy for this, where water purifying stations are absent, except a flexible staybolt, and while numbers of these have been designed and tried, there are none of them that will not soon become inflexible through the hard scale formations around the movable parts. The best bolt, therefore, is one which has the greatest flexibility, and which cannot be affected by scale. Obviously this must be a solid bolt of such material that it possesses requisite tensile strength, combined with the greatest vibratory strength. Copper undoubtedly possesses this combination of qualities to a greater degree than any other metal, and it is the prevalent custom in European countries to use copper staybolts. By us, however, copper is seldom considered, on account of expense.

One of the chief reasons for the superiority of copper staybolts is on account of the fibrous nature of the metal, and the more fibrous we can get a metal having the requisite tensile strength the more vibrations it will stand, and be consequently longer lived. The actual tensile stress on staybolts is far below their elastic limit, and if a bolt is not cracked it is improbable that it will ever break from boiler pressure alone. At the same time this pressure has a great influence on the failure of staybolts, on account of the "vibratory strength" being very much weakened when the vibrations take place while the bolt is under tensile stress. This point was clearly demonstrated in tests made by Mr. Francis J. Cole, and incorporated in his paper before the American Society of Mechanical Engineers in June, 1898; extensive tests since have established the fact beyond question. The greater the stress per square inch the fewer vibrations the bolt will stand. I would recommend an area which will not give a unit stress of more than one-tenth of the ultimate strength. Reducing the diameter of the bolt between the sheets, will, within certain limits prolong its life, the best practice being to have the turned area slightly less than the area at the root of the threads, and leaving as generous a fillet as possible.

The detection of broken staybolts is so important that no precautions should be too troublesome. The old and still-used hammer test is more than unreliable, although some of our largest railroads depend entirely on this means of detection. I once conducted a test of staybolt inspectors. Seven condemned boilers were used, having no drilled bolts, and each inspector went over the bolts, sounding them and marking on a prepared diagram the bolts he considered to be broken. Four of the boilers were under a steam pressure of 50 lbs. and the other three were cold. Afterwards the boilers were cut open and the actual conditions noted. Of 29 inspectors not one got all of the broken bolts in any one boiler, and no one got anywhere near the cor-

*Extracts from a paper by Mr. H. A. Fergusson, presented to the November meeting of the Western Railway Club.

rect number of cracked bolts. Some of these men marked dozens of good bolts as "broken" and passed as many broken bolts for "good." This was the most powerful argument I ever knew against this method of inspection.

The bolt with a hole entirely through is bad on account of its weakening effect, the bolts starting to crack both from the inside and outside when vibrated. Of course, as staybolts always break next to the outer sheet, any hole will be injurious, but by drilling a very small hole, say not over ⅛ in., just through the outer sheet, a break will be detected and the bolt injured very little by the hole, especially if a long-fiber piled iron be used. A ten minutes inspection at the end of a run will disclose any bolts which may have been plugged on account of breaking on the road, and such bolts should be renewed at once. The fact that the all-hollow bolt cannot be plugged while on the road is to my mind an objection to it.

On account of its very short fibers, no bloom iron can possibly stand the vibrations that a piled iron will, as the latter is made up of long slim rods rolled and welded into a tough solid bar, and more nearly approaches copper in its fibrous structure. Some roads still adhere to imported bloom irons, although tests prove them far inferior to our best American piled irons when it comes to vibrations.

There are only a few of our large roads which have standard specifications for staybolt iron, and with one or two exceptions these do not include any test for vibrations. I think it true that most of the roads depend entirely on results of road tests, and rather sneer at laboratory tests as not fulfilling road conditions, and therefore valueless. Laboratory tests of staybolt iron have value, however, if for no other reason than that they give comparative results, and it is safe to assume that if we test two irons in a manner as nearly conforming to actual service as possible, the one giving the best test results will last the longest in the fire-box.

A machine for testing staybolts for vibration while under tensile stress is so easily contrived, that no road need be without one. Simply take an old slotting machine, and arrange a connecting arm to the tool-head which will connect with a special chuck on the work-table. This special chuck is made with a stout body to be bolted to the table, and has a clamp for firmly holding the staybolt test piece. Another clamp, having a jaw to receive the connecting rod, is fastened on the opposite end of the test piece, and a coil spring inserted between the two clamps with a compression nut, gives any required tension on the test piece. The stroke of the slotter is regulated to suit the vibration desired (usually ⅛ in. each side of the center line on a radius of 5 in.) and a revolution counter will automatically count the number of double vibrations.

A slotter fixed up somewhat in this way has been in successful use in the test department at Altoona for several years, and the same arrangement could be applied to a shaping machine, so that staybolt iron could be tested in the machine shop or tool room quite as readily as in a laboratory. We may rest assured that any iron standing say 3,000 double vibrations under a tensile stress of 2,500 lbs. will meet all other requirements as to tensile strength and elongation, besides having the more practical value of giving longer life to the locomotive.

Railroad Regulation.*

I have no ready made remedy for the difficulties which lie behind the railroad problem. The chief cause of the problem is, in my opinion, the inefficiency and utter injustice of the existing system of railroad regulation. Railroad corporations are quasi-public servants, and as such they may be regulated by law, but a railroad like any other corporation is a citizen in the sense that its property rights must be duly respected by the Government. . . . In transportation by water, it is held that as nature has provided waterways, they are free to all, and beyond legislative control. This is a beautiful theory, but in practice successful transportation by water has been made possible only by spending millions of the people's money. Railroads, however, must pay for what they use. No one denies the existence of abuses which grew up with the railroad system. . . . Some form of corrective legislation was necessary, but unfortunately political rather than commercial necessities gave direction to legislative measures.

The original Interstate Commerce act prohibited unjust discrimination, but also contained various prohibitions and requirements, which make up a unique and contradictory scheme of regulation. Pooling or other agreements between rival carriers designed to insure stability of rates and the prevention of wholesale territorial discrimination is prohibited, thus emphasizing the determination to perpetuate competition. The long and short haul provision is the very opposite of the anti-pooling clause. The Sherman Anti-Trust act soon followed the Interstate Commerce law, and it is now a high crime and misdemeanor for two or more agents of rival carriers to agree on rates, rules or regulation of rates, or any other thing which possibly affect the prices of transportation.

Look a moment at a railroad map of the United States. See how roads cross each other at every conceivable angle; how they parallel each other; see how many starting in opposite directions reach finally the same destination, and then say if it is possible, without conference and agreement between competing companies, to adjust rates equitably at all of the thousands of cities and towns. Recall the years of laborious effort to approximate uniformity in freight classification, the lack of which underlies the worst form of discrimination; and then recall the fact that whoever engages in an effort to correct this evil is a felon in the eyes of the law. It is not sufficient to say that in the matter of classification work there is no liability of indictment or conviction. Every individual who engages in the work must take his chances of fine and imprisonment, and every corporation that permits its employees to do so must take the risk of fines. Rates so agreed on are unlawful, but such agreements are necessary to the prevention of transportation anarchy.

Under the laws bearing upon transportation we have what would be a tremendous farce were it not a tragedy. The business world demands such regulation as will insure equitable and stable rates, but under the present form of railroad regulation everything which is essential to this end is specifically prohibited by law.

*From an address by A. C. Bird, Vice-President of the Wabash, the Missouri Pacific, etc., before the Illinois Manufacturers' Association at Chicago, Nov. 10.

Railroads of the United States in 1902.

The advance sheets of the introduction to Poor's Manual for 1903 contain the usual statistics of the railroads of the country at the close of 1902, and some of the figures are printed below. It will be observed that the combined balance sheet shows a considerable increase in funded debt, while the increase in capital stock has been relatively small. There is a good gain in surplus reported, and a decrease from last year in the aggregate deficits. The total length of railroads completed Dec. 31, 1902, is given as 203,132 miles, a net increase for the year of 4,364 miles.

Ton-miles amounted to 156 billion 624 million, as against 148 billions 959 millions, in 1901, and less than 98 billions, in 1897. Passenger miles were 19 billions 707 millions, as compared with 17 billions 789 millions, in 1901. Gross earnings increased 108 millions, to a total of 1 billion 720 millions, and net earnings increased nearly 40 millions, to a total of 560 millions.

The table showing freight and passenger rates, and the returns on total railroad capitalization is of special interest. Gross earnings per mile of road amounted during 1902 to $8,696, and net earnings to $2,830, as compared with $8,270 and $2,668, respectively, in 1901. The average ton mile rate was 7.64 mills; the highest which has obtained since 1897, when it was 7.97 mills. In 1901, the average rate was 7.56 mills. The average interest rate in 1902 was 4.07 per cent.; considerably the lowest on record, comparing with 4.21 in 1901, and the average dividend rate was 2.93 per cent., comparing with 2.62 in 1901. In the 20 year period covered by the table the two highest dividend years are the two extremities, 1902 and 1883, with 2.93 per cent. and 2.76 per cent., respectively, and the lowest year is 1897, when the rate fell to 1.49.

As might have been expected from the relatively slight increase in total capital stock, the amount of this stock per mile of road is less than in 1901; less, in fact, than in 1881, although higher than in many of the intervening years. The characteristic of the figure for capital stock per mile has been the unimportance of the changes in the last 20 years, as shown by the following amounts outstanding at widely separated periods:

Year.	Capital stock per mile.	Year.	Capital stock per mile.
1881	$30,690	1897	$30,526
1886	29,621	1901	30,521
1891	28,310	1902	30,439

But the bonded debt per mile, although less than the capital stock, in the earlier years compared, and as recently as 1900, increased greatly in 1902, as shown in the following table, in which the same years mentioned above are used:

Year.	Bonded debt per mile.	Year.	Bonded debt per mile.
1881	$27,803	1897	$30,153
1886	28,853	1901	30,811
1891	30,855	1902	32,377

The total of stock, bonds and unfunded debt, representing approximately the cost of road and equipment, was $64,371 per mile in 1902, as against $62,926 per mile, in 1901.

The increase in equipment has been noteworthy. The total number of locomotives is given as 41,626; an increase of 1,897 from 1901, and this increase is greater than any reported since 1882. The increase in freight cars amounted to practically 100,000, which is the greatest increase in any one year since 1891.

Foreign Railroad Notes.

French owners of railroad shares complain that they have fallen materially in price, and are now in many cases the lowest for many years. Shares of the Northern Company which sold at 2,119 francs in 1898 and 2,317 in 1900 and 1,906 in 1902 even, sold recently for 1,800, which is the lowest since 1889. Yet earnings are a little better this year than last. In part at least the decline is attributed to government requirements which compel important additional expenditures for labor.

The age of the locomotives mustered out of service in the territory of the German Railroad Union during the last ten years has been: Express engines, 25 years; passenger engines, 35; freight engines, 40; tank engines, 25. Many of the freight engines reached an age of 50 and even 55 years. More significant of their service is a statement of the miles run before the locomotives were broken up, which was, for those for which the data was reported, on the average approximately: Express, 800,000 miles; passenger, 870,000; freight, 750,000; tank engines, 310,000. There are still numerous freight engines in service, substantially in their original form, which were built between 1855 and 1860.

The German railroads continue to have a considerable increase in freight traffic and a slight one in passenger traffic compared with last year. In September freight earnings increased about 6 per cent., and there was a much larger increase in coal shipments. In Austria, however, where the depression has been much greater than in Germany, there is generally no improvement in freight and a reduced passenger traffic.

Railroad Accidents—Year Ending June 30, 1903.*

The Interstate Commerce Commission has issued Accident Bulletin No. 8, bringing its records down to June 30, 1903. As yearly tables are given, we omit the quarterly tables; but the reader should bear in mind that all of the matter down to Table A deals with the quarter, not the full year. The main portions of the bulletin follow:

The number of persons killed in train accidents during the months of April, May, and June, 1903, was 230, and of injured 2,629. Accidents of other kinds, including those sustained by employees while at work and by passengers in getting on or off the cars, etc., bring the total number of casualties up to 12,305 (844 killed and 11,461 injured).

The total number of passengers and employees killed in this quarter, 844, is 83 less than in the quarter last preceding, and the number killed in train accidents, 230, as against 300, shows a still more gratifying decrease; but it is necessary, nevertheless, to record in the present report 23 fatalities as due to three butting collisions. The number of employees killed in coupling and uncoupling cars, 62, is 14 less than in the preceding quarter. The number of passengers killed in train accidents is 31.

The total number of collisions and derailments was 2,605 (1,403 collisions and 1,202 derailments), of which 201 collisions and 126 derailments affected passenger trains. The damage to cars, engines, and roadway by these accidents amounted to $2,476,934, namely: April, $810,272; May, $852,379; June, $814,283.

The list of "Class A" accidents given below is made up on the same basis as in preceding bulletins. The three butting collisions already referred to are Nos. 25, 43, and 5; items 7, 39, and 43. In the case of the most costly one, No. 5, both the flagging system and the block system were employed as safeguards, but both failed or were not properly managed. The other two cases may be called typical of a large number, and their causes as reported are given below. These cases are called typical for the reason, among others, that the elements of the cause are complicated or obscure, or both complicated and obscure; but in No. 25 attention should be called to an element which is rather unusual—the failure of the hand-motion signal. The conductor gave a signal intended to mean "stop," but it was taken by the engineman to mean "go ahead," a fact which indicates either a bad code of signals or great carelessness in giving the signals.

No. 25.—The negligence of the conductor and engineman who caused this collision is described in the report made by the company, as follows:

The stations on this part of the road from west to east are V, M, S, B, etc. The collision occurred a short distance east of M. Train No. 2, eastbound, was delayed about two hours at V. During this time the operator at M received, for train No. 2, three orders—one about 8 o'clock directing No. 2 to meet No. 3 at B; one about 10 o'clock, superseding the first, making the meeting point at S; one at 10.43 o'clock, superseding the second, making the meeting point at M instead of S. This last order was different from the other two in that it read, at the end, "Train No. 2 gets this order at M." Conductor of train No. 2 says he read and understood the three orders when received, and handed the copies to the engineer, simply saying "S——" (the name of the place mentioned in second order), which is the first station east of M, he having mistaken the second order for the last. The engineer failed to read the orders to the conductor to see that the conductor and himself understood them alike, as required by the rule. After the train started the conductor looked at his orders again, discovered his mistake, and signaled with the air signal to stop; then went out on car platform and gave stop signal with his hand, which the engineer

*The *Railroad Gazette* accident records for April, May and June will be found by referring to pages 360, 511 and 543 of this year. Below is a list of the principal accidents in these three months, as shown in our record. To the items in this list we have appended the number of the corresponding item in the list of cases in the Government Bulletin, so far as we are able to identify the accidents.

Prominent Accidents in Railroad Gazette Records.

April 20—Red House, N. Y.	43
April 26—Buffalo, Kan.	5
May 2—South Norwalk, Conn.	6
May 9—McKeever, N. Y.	42
May 27—Bryan, Ala.	41
May 29—Rincon, Cal.	19
June 3—Wedgefield, S. C.	11
June 4—Stilwell, Kan.	23
June 19—Raymond, Ia.	39
June 22—Spokane, Wash.	40
June 21—Point Reyes, Cal.	1

The Government Bulletins for preceding quarters have been published in the *Railroad Gazette* as follows:

Bulletin No. 7, page 557, 1903.
Bulletin No. 6, page 325, 1903.
Bulletin No. 5, page 67, 1903.
Bulletin No. 4, page 833, 1902.
Bulletin No. 3, page 607, 1902.
Bulletin No. 2, page 508, 1902.
Bulletin No. 1, page 309, 1902.

took for signal to go ahead and proceeded at full speed. Before conductor could get to valve to set air brake the collision occurred. Both trains were running at the rate of about 30 miles an hour.

No. 43.—This collision occurred at X. The freight train received an order at W, 17 miles east of point of accident, at 1:47 a. m., to the effect that *second* No. 2 would run one hour and thirty minutes late. The railroad company's report says:

As the entire crew on the head end of the train were killed outright we have no means of ascertaining their understanding of the order, but the conductor, and no doubt the engineman likewise, read the order as *No.* 2 instead of *second No.* 2. As a safeguard against errors of this nature, the rules require the conductor to show his orders to the flagman and the engineman to the fireman, who are required to read, understand and keep them in mind. In this instance the conductor failed to fulfil the requirements of this rule, as he did not show the order to the flagman. The indications are that the engineman was also derelict in this respect. The flagman was on the engine at the first station east of X (8 miles) and asked the engineman what orders he had. The engineman replied, "One hour and thirty minutes on No. 2." This answer was made in the presence and hearing of the fireman and head brakeman, so it is evident neither of these men had seen the order, as it is fair to assume they would have corrected the engineman.

On returning to the caboose the flagman made inquiry of the conductor regarding the orders, and was informed identically the same as he had been by the engineman, to the effect they had one hour and thirty minutes on *No.* 2.

How these men came to make such an error is beyond human understanding. The order was clear and simple, plainly written, and the usual standard form of "run-late" order. The conductor was unable to offer any explanation of how he came to be misled. The only solution is that possibly the engineman and conductor had been figuring where they would go for No. 2 and, on receiving the order, their minds were so concentrated on No. 2 that they were not impressed with the word "second." The order had been in their possession one hour at the time of accident. No. 2 was practically on time—about three minutes late. The accident occurred on a curve and at the mouth of a deep cut, so the approach of the trains could not be discovered in time to make any effort to stop; the collision, therefore, took place at high speed, No. 2 moving 40 miles per hour, the freight train probably 25 miles per hour.

Both the conductor and engineman were young men, each about 27 years of age, in good health, and physically sound. The crew had been on duty fourteen hours and twenty-five minutes. The conductor and both brakemen had eleven hours' rest, and the engineman and fireman had been off duty twenty hours prior to going out on this trip.

Conductor had been in service six years, promoted to conductor in August, 1901; record good. Engineman had been in service four years, promoted to engineman November, 1902; record perfect.

Items 3, 5, and 13 in Class A represent cases due to failure to observe block signals or to "failure in block working." In Items 2, 8, and 41 men fell asleep on duty, and item 33 brings out a kind of carelessness which has not before appeared in the records.

In view of the prominence of butting collisions in the quarter under review a second table is given showing all of this class of accidents (regardless of the cost limit) which are reported as due to mistakes of conductors and enginemen in reading orders or to forgetting orders; mistakes of telegraph operators and train dispatchers in writing, transmitting, or delivering orders, and mistakes of conductors and enginemen in regard to the right to the track. This table contains 36 items; deaths, 33; injuries, 260.

CAUSES OF FORTY-THREE PROMINENT TRAIN ACCIDENTS (CLASS A).

[NOTE.—R. stands for rear collision; B., butting collision; M., miscellaneous collisions; D., derailment; P., passenger train; F., freight and miscellaneous trains.]

Item.	Record No.	Class.	Kind of train.	Killed.	Injured.	Damage to engines, cars and roadway.	Cause.
1	12	M.	P.....	2	..	...	Passenger train broke in two; 2 passengers standing on car platform fell off and were killed; cause of failure of coupling unexplained.
2	2	R.	F. and F....	..	..	$2,200	Occurred 4 a. m. Engineman fell asleep and failed to regulate speed as directed by caution card; had been on duty 15 hrs.; in 3 years had been suspended 5 times.
3	1	R.	F. and P....	1	22	2,300	Occurred 3 a. m. Runner of light engine disregarded block signal; fireman was killed.
4	56	D.	P.....	..	4	2,700	Tender rocked; tender had no splash boards in tank.
5	23	R.	F. and F....	1	2	3,000	Signalman allowed 2 trains in same block section; engineman ran at excessive speed; conductor failed to notice this fault. Conductor's experience, 5 months; signalman's (on this road), 5 months.
6	33	M.	P. and F....	2	6	3,600	Freight backed into side of passenger train; hand signal wrongly given by brakeman of 6 weeks' experience.
7	25	B.	P. and P....	2	33	4,000	Conductor and engineman of eastbound train failed to read and understand telegraphic orders. (See further explanation in text.)
8	9	B.	F. and F....	1	3	5,368	Engineman disregarded stop signal at station; had fallen asleep. Fireman neglected to warn him; conductor tried ineffectually to warn engineman.
9	10	B.	F. and F....	..	..	5,600	Error of train despatcher. Duplicate order system not in use. Despatcher 47 years old, experienced.
10	8	B.	F.and F....	..	1	5,894	Error of train despatcher; gave "lap order."
11	60	D.	P.....	5	38	6,058	Washout; daylight.
12	36	D.	P.....	..	..	6,525	Washout; despatcher failed to notify train to run cautiously; despatcher's experience, 3 months as operator, 5 months as despatcher.
13	41	R.	P. and P....	..	5	6,700	Signalman at A gave clear signal to second train when first had been stopped just short of signal cabin at B; signalman's experience, 13 nights. Flagman of foremost train was back 1,000 feet; foggy night.
14	28	B.	F. and F....	..	3	6,900	Engineman, westbound, failed to stop at meeting station; was suspended 30 days. Fireman (experience, 2 years) suspended 2 weeks for not asking to see despatcher's orders. Conductor and rear brakeman tried ineffectually to stop the train; forward brakeman not acquainted with the road.
15	29	B.	F. and F....	..	6	8,500	Mistake of operator in copying telegraphic order; wrote "78 204" instead of "7th 204." Operator's age, 18; experience, 6 days as operator, 15 months as apprentice. The company advises that since the collision a rule has been made requiring that, in despatchers' orders, words like "seventh" be spelled out in full. It is to be observed, however, that in this case the substitution of "78" (which was the number of a passenger train) for "7th" made the order irregular, because if train 78 had been meant the figures would have been preceded by "no."
16	42	B.	P. and P....	..	45	9,000	Operator gave conductor clearance card and neglected to give him telegraphic order; operator's experience (at this place), 3 months.
17	18	D.	P.....	2	5	9,638	Occurred 3 a. m. Misplaced switch; switch left in wrong position by brakeman of freight. Before the derailment a passenger train had run through the switch in the opposite (trailing) direction with switch light showing red.
18	50	B.	F. and F....	3	1	9,775	Engineman of light engine forgot regular train; he was killed.
19	40	D.	P.....	..	34	10,335	Unknown. Track of 80-lb. rails, rock ballast, in good condition; curvature 2½ degs.; speed, 35 miles an hour.
20	39	D.	P.....	2	12	10,400	Unknown.
21	4	B.	P. and F....	2	15	10,600	Conductor and engineman of freight misread telegraphic order. It read "2d 26," and they read it "26."
22	7	B.	F. and F....	2	10	10,900	Station agent (32 years' experience) failed to deliver telegraphic order. Signal stands normally in "stop" position; agent cleared it with order lying before him on desk.
23	45	B.	P. and P....	9	18	11,444	Pilot forgot meeting order; no other person on train acquainted with road.
24	54	M.	F. and F....	..	..	11,969	Runaway of 26 cars of ore; cars, detached from engine, had been left unattended; hand-brakes set on 10 cars; air in air-brake cylinders leaked out.
25	49	B.	F. and F....	..	9	12,300	Operator neglected to deliver telegraphic order.
26	55	M.	F.....	..	..	12,300	Train broke in two; cars much damaged by automatic setting of brakes.
27	22	D.	P.....	..	14	13,600	Derailment due to some part of engine or car dropping to the roadbed.
28	27	B.	F. and F....	1	5	14,200	Engineman, northbound, started from station on time of southbound; was "under the impression" that he was to meet southbound train at a station farther on.
29	31	M.	P. and F....	1	28	14,250	Passenger train struck by unattended light engine; it is believed that the engine had been started by a certain brakeman, who soon after disappeared.
30	16	D.	P.....	5	2	14,251	Broken rail; rail, 67-lb., not badly worn; curvature, 4 degs.; speed, 35 miles an hour; general condition of track, good; weight on engine driving wheels, 100,000 lbs.
31	61	D.	P.....	1	9	14,800	Loosened switch; switch believed to have been maliciously tampered with.
32	57	D.	F.....	..	..	15,000	Broken flange.
33	6	B.	P. and F....	3	4	15,055	Passenger train was several hours late; conductor and engineman of switching crew, who had been at work at a rolling mill all day, entered main line at 7 p. m. without examining register; engineman "thought" he had heard the passenger train pass.
34	65	D.	F.....	..	3	16,800	Unknown.
35	46	B.	P. and F....	..	7	17,800	Conductor and engineman of northbound freight calculated to meet southbound passenger train No. 7 at A, but at A they received an order against another southbound train and thereupon started out, forgetting train No. 7.
36	62	D.	F.....	..	..	11,400	Unknown.
37	32	M.	P.....	1	8	25,000	Occurred at 11 p. m. Passenger train struck car which had been blown out of side track by high wind.
38	13	M.	P.....	..	1	25,900	Passenger train ran into officers' car which had been carelessly pushed from side track on to main line. Fire set by heater in officers' car.
39	43	B.	P. and F....	7	7	29,400	Occurred 3 a. m. Trains running at full speed; conductor and engineman of freight had an order concerning "2d No. 2," but read it "No. 2."
40	67	D.	F.....	..	..	29,772	Runaway of 73 loaded cars. Cars had been left at 5 p. m. with hand-brakes set on 30 of them; runaway occurred next morning at 4 o'clock; brakes must have been released by some person or persons unknown.
41	30	B.	F. and F....	7	2	31,000	Operator fell asleep and failed to deliver telegraphic order; conductor and engineman neglected to ask for clearance card.
42	24	B.	P. and P....	2	45	32,000	Engineman southbound, misread telegraphic order; conductor neglected to have order read aloud in his presence by engineman.
43	5	B.	P. and F....	7	14	73,000	Occurred 3 a. m. Eastbound passenger collided with side of a westbound freight which was entering side track; brakeman of freight had gone forward with red light, but passenger engineman did not see this signal; block signalman in tower a short distance west of point of collision reported that freight had cleared main track when, by reason of darkness, fog and distance, he did not know. Signalman's experience, 1 year.
			Total....	69	421	$581,234	

YEARLY TABLES.

This bulletin completes the publication of the accident records under the law of March 3, 1901, for two years, and the following table (A) covers the year ending June 30, 1903. The total number of casualties shown in Table A is 49,531 (3,554 killed and 45,977 injured).

Table A.—Summary of Casualties to Persons.

	Passengers. Kil'd.	Passengers. Inj'd.	Employees. Kil'd.	Employees. Inj'd.
Collisions	118	2,891	561	3,781
Derailments	44	1,458	264	1,714
Miscellaneous train accidents (excluding the above), including locomotive boiler explosions	2	75	70	945
Total (train accidents)	164	4,424	895	6,440
Coupling and uncoupling cars	..	...	253	2,788
While doing other work about trains, or while attending switches	..	...	149	5,538
Coming in contact with overhead bridges, structures at side of track, etc.	4	32	93	992
Falling from cars or engines, or while getting on or off	119	1,335	678	8,025
Other causes	34	1,182	1,165	15,221
Total (other than train accidents)	157	2,549	2,338	32,564
Total (all classes)	321	6,973	3,233	39,004

In Table B, following, comparisons may be made of the totals of the principal classes of casualties. For the large increase in the totals and in nearly all of the items an explanation is to be found in the well known and widespread increase of railroad traffic which has taken place and which has been made apparent by the published reports of railroad earnings. This tendency was remarked upon in Accident Bulletin No. 5, the first for the fiscal year now under review. It is also to be noted that the course pursued by the Commission in insisting on full reports of all accidents has been productive of good results, and, as noted in Bulletin No. 6, railroad companies are much more careful to include *all* accidents in their reports to the Commission than they were when the law requiring reports of accidents went into effect. There has been a steady and continuous improvement in this respect, and it is undoubtedly true that much of the increase shown in the above comparative summary is due to the fact that accidents are now much more fully reported than they were during the preceding year. Notwithstanding this great increase, it is gratifying to note that the list of fatal accidents to passengers in train accidents is no larger than last year. The only other item which does not show an increase is "overhead obstructions." It is not unlikely that the decrease in this class of accidents has been brought about by the increased use of air-brakes, doing away, to some extent, with the necessity of requiring trainmen to ride on the tops of box cars.

It appears that the number of men employed in the train service on June 30, 1903, was about 12 per cent. larger than on June 30, 1902. This is the total for the whole country. On the roads of densest traffic, where the liability to accident is greater than on roads of light traffic, the increase has been more than 12 per cent. The enormous expansion of freight traffic has led to the employment of new men so rapidly that the percentage of inexperienced men in the service was in the year under review larger than before for many years.

Table B.—Casualties to Passengers and Employees.

	1903. Kil'd.	1903. Inj'd.	1902. Kil'd.	1902. Inj'd.
Passengers—				
In train accidents	164	4,424	167	3,586
Other causes	157	2,549	136	2,503
Total	321	6,973	303	6,089
Employees—				
In train accidents	895	6,440	697	5,046
In coupling accidents	253	2,788	143	2,113
Overhead obstructions, etc.	93	992	104	1,070
Falling from cars, etc.	678	8,025	537	6,867
Other causes	1,314	20,759	1,035	18,615
Total	3,233	39,004	2,516	33,711
Total pass. and employees	3,554	45,977	2,819	39,800

Table C.—Collisions and Derailments; Damage to Cars, Engines and Roadway.

	1903. No.	1903. Loss.	1902. No.	1902. Loss.
Collisions—				
Due to trains separating	948	$487,530	774	$391,489
Other causes	5,219	5,128,216	4,268	3,894,194
Total	6,167	5,615,746	5,042	4,285,683
Derailments due to—				
Defects of roadway, etc.	821	636,718	547	443,706
Defects of equipment	1,841	1,502,325	1,609	1,295,299
Negligence of trainmen, signalmen, etc.	297	230,907	255	136,241
Unforeseen obstructions, etc.	277	317,456	239	546,478
Malicious obstruction of track, etc.	71	157,290	57	63,246
Other causes	1,169	1,136,535	926	874,753
Total	4,476	3,981,231	3,633	3,359,728
Total collisions and derailments	10,643	9,596,977	8,675	7,645,406

Following this are tables showing in minute detail the causes of accidents to employees in coupling and uncoupling cars, and in falling from and getting on or off cars and engines.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The embargo on transportation in Texas by State and by local authorities, due to a fear of the spread of yellow fever, would be ridiculous if it were not also tragic. The railroads have, so far as it appears, tried only to obey orders, with the result that the plague-stricken region has been spasmodically, but not consistently, shut off from the rest of the world, and this with horrible and disastrous accompaniments of neglect, starvation and a further spread of the region of contagion which might have been expected, and which was the inevitable result of an ignorant and brutal attempt to confine stricken communities. The disease appeared in Laredo, on the Mexican border, and something like 700 cases developed there. Communication was theoretically shut off, but in spite of it, and indeed because of it and because of a lack of elementary knowledge of the sole means of contagion, yellow fever cases soon appeared at San Antonio, 150 miles north by direct line of railroad communication. Dr. Yale, of New York City, an eminent authority, shows clearly in another column the relations of this and of other contagious diseases to transportation:

> So far as is known at the present time, this disease is only communicated through the agency of mosquitoes; the organism which causes the fever being partially developed in a mosquito and completing its development within the human body. If this scientific belief is correct, it is obvious that the disease could not be carried by a train unless that train carried a patient already sick of the disease, or carried infected mosquitoes, which had obtained the infection from cases elsewhere. In case of a suspicion of danger from yellow fever, the natural and proper protection of a community would come from the isolation and watching of the case and the guarding of that case most carefully from attacks of mosquitoes, which might, if infected from it, carry the disease elsewhere. The ordinary proper sanitary care in use in all contagious diseases should also be employed; but, so far as the railway itself is concerned, beyond the duty of not knowingly carrying people affected with this disease and a reasonable endeavor to keep mosquitoes from riding free, we cannot see that the road has any further responsibility in the case.

But the railroad company has this much responsibility, and being surely a better organized, more scientific, and more prompt-acting machine than are the communities through which its lines run, it should lead and not follow in carrying out the easily devised methods of stopping the plague; not by oppression and making life hideous in Laredo and San Antonio, and by costly and foolish attempts at useless disinfection, but, knowing the only means of infection, prevent that alone and effectually.

The newspapers have been talking of negotiations between the railroads and the iron manufacturers by which lower freight rates on iron and steel would be made by the railroads in exchange for lower prices for steel rails. It seems to be assumed that this might be an equitable bargain, as if all the railroads were equally concerned in the iron traffic. On the contrary, perhaps nine-tenths of the railroad mileage of the country has little to do with the traffic in materials to and products from the blast furnaces and rolling mills; the interest of the Pennsylvania Railroad in it is probably ten times that of the New York Central, and fifty times that of the Pacific railroads. The Pennsylvania, and roads similarly situated, are not likely to help pay by reduced freights for the rails used by other railroads. This does not mean that they will not reduce rates on iron. They are almost sure to do that when thereby consumption can be increased; and the history of the iron industry shows that when it comes to the pinch that blast furnaces, etc., must be closed unless prices to consumers are reduced, the railroads will carry for bare cost rather than have nothing to carry. But before that time comes the profits of the iron industry must approach close to the vanishing point. The price of rails of late years has probably been higher in proportion than that of most other iron products, and has yielded large profits to the rolling mills; but the railroads themselves are accustomed to make larger profits on some kinds of traffic than on others, and they have in most cases not complained much, because they too were having a season of prosperity. Rails have long been a comparatively unimportant element in working expenses. In the year ending with June, 1902—a year of very free expenditures for maintenance, and of the highest price for rails—the 200,000 miles of railroad in the country expended less than $17,000,000 for rails for renewals, which was little more than 1½ per cent. of their total working expenses. If they had paid $18 (the lowest price ever known) instead of $28 per ton for rails, it would have reduced their expenses about $30 per mile. Renewals, it is true, make but a part, and the smaller part, of the total rail consumption; but they alone have an effect on working expenses. Of course economies are effected only by saving a little in each of a multitude of items; and if there should be general reduction in prices, or of iron prices alone, rails will have to suffer with the rest. But to judge from the amount of talk on the subject, rails should be a chief item in railroad expenses, which they ceased to be long ago. In the year referred to, locomotive fuel cost seven times as much as rails and tie renewals nearly twice as much; wages, forty times as much.

Loadings for Railroad Bridges.

The discussion in the American Society of Civil Engineers, which is printed almost in full in another column, is interesting and timely. Within the last few years many comparatively new bridges have been replaced with structures capable of carrying the heavy engines and cars which have been put into service, and many others while still in use are being badly overstrained. The problem which confronts the bridge engineer in putting up new bridges is to provide for future increases in loading and at the same time guard against a waste of money in building a bridge too strong. The Monongahela bridge of the Wabash at Pittsburg is a good example of a modern steel railroad bridge designed for a very high limit of heavy traffic. Mr. Henry W. Hodge, one of the engineers of the bridge, in opening the discussion gives the reasons for assuming the loadings which were used in its design, some question having been raised as to the necessity for such heavy loadings as were assumed. Mr. Theodore Cooper, in reply, questions the need of using any greater loads than are assumed in his E-50 loading. A careful analysis of the arguments on both sides seems to show that Mr. Cooper is not far wrong.

Given a new line, built with the accepted standard clearance limits and with unlimited possibilities of heavy traffic: For what loads should the permanent structures be designed to meet any future increase in weight or capacity of the rolling stock over the present maximum values. This is the basis for the discussion. Considering the locomotive first: The gage of the track determines the width between frames and limits in one dimension the space that can be occupied by the parts under the engine. The clearance width of 10 ft. 2 in. limits the width of the cab and, deducting from this a suitable space for the engineman at one side, gives the maximum diameter of boiler. With the gage of the track and hence the center line of cylinders fixed, the diameter of cylinders is also limited by the clearance width. To keep inside the limit of height, using the diameter of boiler determined by the clearance width, the position of the center line of boiler is fixed and the space under the boiler between frames confined in its vertical dimension.

An example of locomotives closely approaching the clearance limits are the "Santa Fe" type engines recently built by the Baldwin Locomotive Works. These engines are the heaviest ever built, and have a 2-10-2 wheel arrangement with 234,580 lbs. on drivers. The cab is 10 ft. 3 in. wide, and the boiler, 88 in. in diameter. The extreme height from rail to top of stack is 15 ft. 6 in. The driving wheels are 57 in. in diameter, and are spaced 60 in. center to center, or about as close as they could be crowded in. This type of engine is a clearly defined development of the 2-10-2 and 2-8-0 types. The Santa Fe in 1902 ordered a decapod which at that time was the heaviest locomotive in the world. This was followed last spring with the "Mikado," or 2-8-2 type, with 7,800 lbs. less total weight and 37,800 lbs. less on drivers, the latter engine having 200,000 lbs. on four driving axles, as against 237,800 lbs. on five axles in the decapod. The latest 2-10-2 engine has a greater total weight than either of the others, but 3,220 lbs. less on drivers than the decapod, with the same number of driving axles. It is interesting to compare the total weight per foot of length of wheel base in these three types. The decapod with a 29 ft. 10 in. wheel base weighs 8,930 lbs. per foot, the "Mikado" with a wheel base of 31 ft. 6½ in. weighs 8,230 lbs. per foot, and the "Santa Fe" type weighs 8,000 lbs. per foot with a 35 ft. 11 in. wheel base. Comparing the total weight per foot of length from center of leading truck to rear end of frame in the 2-10-0 and the 2-10-2 types; the first has a total length of 37 ft., which gives 7,230 lbs. per ft., and the second has a length of 40 ft. ½ in., which gives 7,180 lbs. per ft. In other words, to increase the weight of this type of engine, 1 ft. must be added to the length for every 7,200 lbs. added to the weight. This value is practically the same for the 2-8-2 type. If another driving wheel were to be added, the length would have to be increased about 6 ft., and the total weight would be increased about 43,000 lbs., or nearly the equivalent to the driving axle load in the present engines. It would hardly be practicable to lengthen out the locomotive and add this additional weight without introducing another pair of either driving or truck wheels to support it, not because the axle loads would be increased to a dangerous degree, but because the increased stresses in the frame and boiler would necessitate a much heavier section throughout.

The individual axle loads in these three successive types are well within the maximum values. The 2-8-0 engines of the Bessemer & Lake Erie have axle loads as high as 56,000 lbs., and many of the recent 4-4-2 engines have axle loads as high as 55,000 lbs. The Santa Fe 2-10-2 type has axle loads of only 46,916 lbs., the 2-10-0 loads of 47,560 lbs. and the 2-8-2, loads of 50,000 lbs. It hardly seems necessary, in view of these facts, to assume for the calculations of new bridges a value of 64,745 lbs., as Mr. Hodge suggests. Not until the clearance limits have been materially increased, will it be likely that the average road can build engines with any such weights on a pair of drivers. Future increases in weight of locomotives, if such take place, will probably be accompanied with new wheel arrangements, possibly along the line of the articulated engines soon to be tried on the Baltimore & Ohio. Such an engine is in reality two engines in one, and should be considered as such for the purposes of bridge design.

In considering the limit of capacity of freight cars, other things besides the mere possibility of increasing the loads, must be taken into account. Much of the economy of operation of American railroads is due to the very large train loads hauled. There seem to be possibilities of further economies in this direction with the use of more powerful engines if they can be built and better utilization of space in loading the individual cars than now prevails. If a certain number of cars of given capacity represent the train load which a locomotive can haul and if the power of that locomotive be increased there is not the same relative economy to be attained by increasing the capacity of each car to an amount equivalent in the total train load to the increased power of the locomotive. By far the greater proportion of bulk and miscellaneous freight cannot be loaded into a box car of American Railway Association standard dimensions so as to utilize the entire cubic contents of the box, and bring the loading up to 100,000 lbs. Only a very few commodities—minerals and extremely heavy articles like paper—can be loaded to the best advantage in a car with the dimensions of cross section adopted as to standard. The figure which Mr. Cooper gives, as likely to meet any future increase in capacity of cars is a conservative one. In only a few cases could 5,000 lbs. per foot be exceeded with the present clearance limits, and that on roads with a special mineral traffic. Here again an increase in capacity must be met with an increase in length which, so far as the bridge engineer is concerned in assuming the cars in the train as a uniform load of so much per foot, makes little difference in his calculations unless the individual wheel loads run up to a very high figure. If the Wabash bridge at Pittsburg has been designed for the loads which Mr.

Hodge recommends, it is certainly strong enough to stand for many years to come. On such a work it is just as well perhaps to overestimate when, for lack of positive premise, the tendency would be to underestimate.

An unusual number of high officers of advanced age in the Prussian State Railroad service have latterly been put on the retired list, and what seems a semi-official explanation has been given in a Berlin newspaper. The government has the right to retire members of all its numerous administration corps when they have passed their 65th year, just as officers of our army and navy are retired; but the retirement is not required by law, as in our army; and the government exercises its discretion when the official reaches 66. If retired, he has certain pay and allowances, like our retired army officers. But the present Prussian administration is convinced that the higher positions in railroad service demand the capacity to make quick decisions and exercise energetic action—in this approximately military service; and this capacity rarely persists at an advanced age, even while knowledge as well as experience increases. In many branches of the administration the qualities of energy and quick decision are of much less importance than accuracy, fullness of knowledge, and wisdom; in the active railroad service they are indispensable. Therefore continuance in it after 65 will be exceptional—at least, much less usual than in most other branches of the civil service. A further reason for the retirement of old high officials is one which has had a great influence in the military service; namely, to make room for the promotion of younger men, who are less likely to distinguish themselves in subordinate positions if the promotion which is the sole reward for extraordinary efficiency comes so late or so seldom that it exercises little stimulus.

At its Richmond meeting the American Railway Association approved a rule of a dozen lines, to be used on "portions of the road so specified" (where the block system has been established) authorizing conductors and enginemen to run by the block signals, and disregard the rules of the time-table by which trains are governed where the block system has not been introduced; and the funniest things that we have read in the daily papers since then have been the headlines describing this action of the Association as an epoch-making revolution. The reporters got the idea that on January 1 next the block system was to be adopted on every double track railroad in the United States. The fact that the rule in express language applies only to specified portions of a railroad appears to have escaped them—or perhaps some railroad officer jollied them. Several editors make this "news" the subject of editorial comment, and one imaginative one says that the innovation "will save millions of dollars yearly." From the superintendent who is postponing the introducing of the block system because it costs too much, this will elicit a groan. Here and there a local editor has suspected the accuracy of the despatch, and has asked railroad officers for information; and one such was informed that the block system "is so much in the experimental stage" that its general adoption is not likely. Inasmuch as the system has been used on the Pennsylvania railroad for 30 years, and even in the wild west for 10 years, this item is funnier than the original fiction. For nonchalance in distorting facts while all the time enjoying to the full the delights of a sunny disposition, the American reporter is unapproachable. The all-wise coroner's jury and the political spellbinder are no longer in the race.

On the Illinois Central an order has been issued requiring flagmen, when they go back to protect the rear of a train, to remain standing, and not sit upon the track to await the approach of a train; and the man must remain in the center of the track. This is published by Chicago newspapers. Those people (including some railroad officers) who think that the regard for his own safety which is supposed to be constantly alive in every man's mind, is enough to impel a trainman to always vigilantly guard his train, should pin this in their hats. Let no one think that the order is unnecessary or based on an exaggerated idea of the danger. The fear of death can be as completely nullified as any other habit of mind. The reason why this order comes out at this time is to be found, no doubt, in the enormous freight movement of the last two years, which has led thousands of men to work too long without rest. The Government accident bulletins have developed this phase of the situation. And, sad to say, brakemen are not the only ones who sleep on duty. Locomotive runners often appear in the record; oftener, indeed, than brakemen, for the brakeman sometimes, perhaps nearly every time, causes no harm except to himself, and so is not mentioned in the Bulletin.

The experiments at high speeds in Germany were made, as we have noted, at the instance and chiefly at the expense of two great electrical manufacturing companies, each of which was to provide a motor car. The experiments heretofore described this fall, however, were made only with the Siemens & Halske motor. This, it seems, was because the car built by the General Electric Company was not then finished. Very soon after the experiments with the Siemens & Halske cars, however, it was ready; and on Oct. 27 it attained a speed of 210 kilometers, or 130½ miles an hour, the highest ever reached. Seven different runs were made before it was permitted to attempt 200 kilometers. The General Electric Company claims special advantage for an arrangement of the motors on springs, and apparatus for very gradually and regularly increasing the motor current. There is no competition as to speed between the two companies, however, and the speed attained depends chiefly on the current supplied. The track in all the trials was protected by guard-rails. The inside of these was chalked in places, but on examination it appeared that the wheels never touched the guard-rails in any of the trials.

Baltimore & Ohio.

Great gains have been made in earnings since this property passed into active Pennsylvania control, in May, 1901, and the present year is considerably the best in the history of the road. The extensive grade change and construction work undertaken several years ago is bearing fruit in increased train load and operating efficiency, and is now sufficiently progressed so that the extraordinary appropriations out of income should soon be capable of great reduction. In 1901, besides the charges for maintenance, $2,500,000 was appropriated out of surplus income for this betterment work; in 1902 a similar appropriation was made, and this year it has been increased to $3,500,000, so that $8,500,000 has been set off from surplus income in three years, by special appropriation, after a charge for miscellaneous betterments which it was not desired to capitalize, amounting in the aggregate to $1,079,500. The magnitude of the betterment work done under the new control may perhaps be best shown in a table classifying the charges as against capital or income:

Capital.	Aggregate charge, 1901, 1902, 1903.
Capital account, cost of road	$12,115,966
Capital account, cost of other roads owned by B. & O.	760,743
Railroads in General Account	2,670,722
Real estate	3,165
Income.	
Appropriation from surplus	8,500,000
Additional charge against income	1,079,500
Total	$25,130,096
Total per mile, average mileage during period	$7,261

This, as stated, is exclusive of the charge for maintenance of way and structures, which amounted this year to $6,175,116, or $1,569 per mile; last year to $7,235,389, or $2,238 per mile, and in 1901 to $5,721,695; $1,779 per mile. The advantageous physical characteristic of the road in that its topographical summit and its traffic summit nearly coincide, was discussed in the *Railroad Gazette* Aug. 22, 1902, page 651, in connection with a description of the betterment work. It was then pointed out that the great tonnage of the road was coal and coke, originating in the mountain country east and south of Pittsburg, and that grades were being adjusted both eastbound and westbound from this summit.

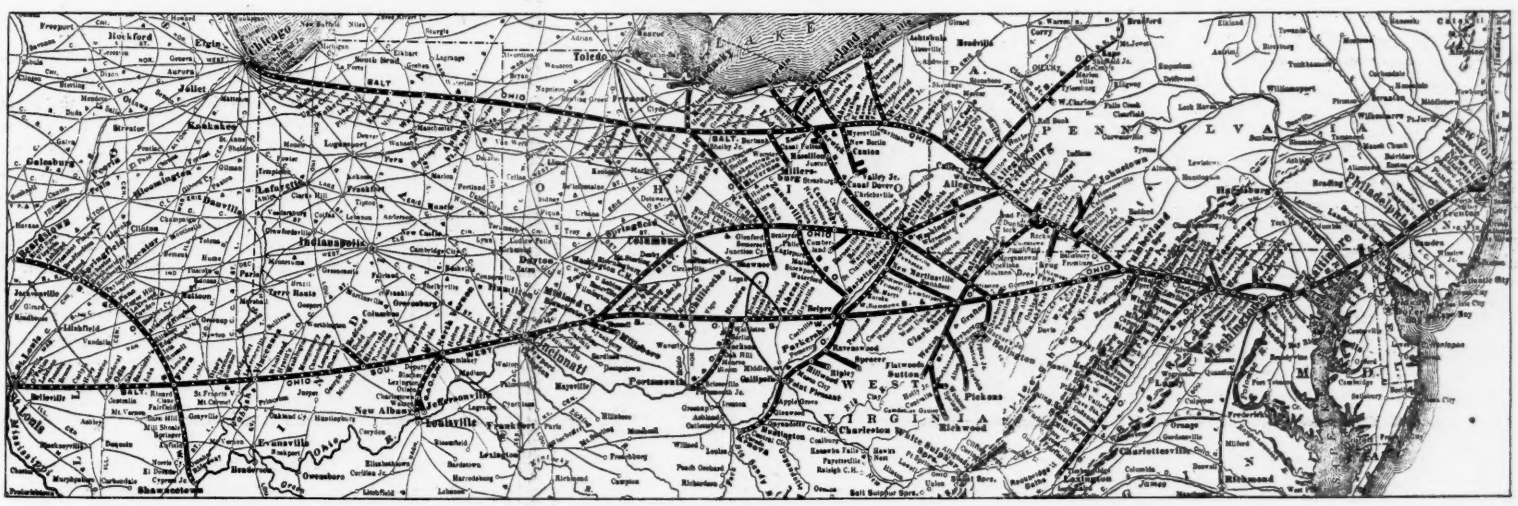
Train loading is a good barometer of the success of grade revision, and the gains which have been made in this respect are very significant. In 1899, average train load for the system was 342 tons; in 1900, 372 tons; in 1901, 375 tons; in 1902, 406 tons, and in 1903, 416 tons. There are only eight or nine railroads in the country which report an average loading as large, or larger, than this.

Gross earnings of the Baltimore & Ohio, including the Baltimore & Ohio Southwestern, were $63,449,633 last year, as against $57,892,495 in 1902, and operating expenses were $39,569,964, as against $37,006,984 last year, leaving net earnings from operation of $23,879,670 as against $20,885,511, an increase of nearly three millions. Unlike the majority of the roads which have been reviewed this fall, the percentage of expenses to earnings decreased, amounting to 62.36 as against 63.93 last year, although the operating ratio on lines controlled by or affiliated with the Baltimore & Ohio, reported separately, increased from 59 per cent. to 67 per cent. The relative economy in expenses on the main system was considerably furthered by the reduction in the charge for maintenance of way and structures, which was over a million dollars less this year than in 1902, but was apparently quite ample. Maintenance of equipment increased $885,825, however, and conducting transportation increased $2,706,885. The item of Other Income also showed a substantial increase during the year owing to gains in interest on securities owned, so that gross income for the year amounted to $25,489,520, as against $22,120,731 last year, and net income, owing to a decrease in interest and rentals paid and in discount and commission on securities sold, amounted to $13,818,163, after a charge of $573,374 for miscellaneous improvement work not otherwise accounted. This is an increase of $4,644,388 from 1902, or over 50 per cent. From this net income, after a special appropriation of $3,500,000 for additions and improvements, 4 per cent. dividends were paid on the preferred stock and 2 per cent. on the common in addition to the 2 per cent. paid on the common from last year's surplus, making a total of 4 per cent. on each class of stock. A surplus of $5,432,922 was then carried forward as the year's contribution to profit and loss; a notable showing.

The capitalization of the company was greatly increased this year by the allotment to shareholders at par of $42,316,860 common stock, being 30 per cent. of their holdings of preferred and common as authorized in September, 1902. There were also converted into common stock $5,949,000 ten year gold convertible debenture 4 per cent. bonds. Pittsburg, Lake Erie & West Virginia system 4 per cent. refunding mortgage bonds were issued to the amount of $2,884,000 and an aggregate of $3,100,000 prior liens 3½'s, first mortgage 4's, and Southwestern division 3½'s, were also issued for improvements, betterments and extensions as provided by the respective mortgages. The total increase in capital liabilities as shown on the general balance sheet after the deduction of the ten year gold convertible debentures referred to above, amounted to $49,313,882. The item Cost of Road shows an increase of $8,541,991, covered by stocks and bonds of sundry companies acquired during the year and placed with trustees under the provisions of the respective mortgages, and construction expenditures of the year charged to this account. The ledger value of stocks owned by the company shows for the year an increase of $22,231,313, due to the purchase of large holdings of both preferred and common stock of the Reading Company, the acquirement of the outstanding stock of the Fairport Warehouse & Elevator Company, which now vests the entire ownership in the Baltimore & Ohio, and of other stocks.

Last year it was estimated in the *Railroad Gazette* that over 10 per cent. had been earned on the common stock of the company after satisfying the requirements of the preferred. In spite of the great increase in common stock this year, the net income seems to have been sufficient to have paid over 9 per cent. on the total common stock, had it been so desired.

Construction work during the year includes a large export and import pier begun at the Locust Point termi-



Baltimore & Ohio.

nal, which has not been extensively improved for many years, owing to the difficulty of continuing operation meanwhile. About 60 per cent. of the work is now completed and the pier will permit the terminal facilities there to be remodeled on a comprehensive plan, the work upon which can be extended over a series of years. The work on the Cherry Run & Potomac Valley Railroad, between Cherry Run and Wilsons, W. Va., is approaching completion, and considerable right-of-way has been purchased in view of an extension of this line from Wilsons to Harper's Ferry. The line affords a grade of 15.8 ft. against eastbound traffic, obviating the necessity for the pusher engines now employed on the present line, and a westbound grade of 26.4 ft. is also substituted for the present grade of approximately 1 per cent. Other work done includes the completion of extensive improvements on the Baltimore division; second-track on the Connellsville division, completed except at Indian Creek; the opening of the Quemahoming branch railroad; completion of third and fourth track work between Connellsville and Broadford, practical completion of second track work on the New Castle division between New Castle Junction, Pa., and Struther's, Ohio, 14 miles; 27 miles of second-track now building on the Cleveland, Lorain & Wheeling, south of Holloway; the approaching completion of the Medina cut-off on this line; expensive yard work nearing completion at the five terminal points, Keyser, Fairmont, Connellsville, New Castle and Holloway, etc. During the year 578 miles of track were ballasted and 36 miles of main track, 59 miles of second-track and seven miles of third and fourth track were added to the system.

Freight density during the year, excluding company's freight, amounted to 2,181,518 ton miles per mile of road, an increase of 46,888 from 1902, and 159,298 passenger miles per mile of road were reported, an increase of 17,018. The total freight earnings were $47,756,251, an increase of $3,976,465, and freight earnings per mile of road amounted to $12,136, an increase of $864.25. Average ton mile earnings showed an increase of nearly 3 mills.

The chief traffic changes in the year were the increases of 724,672 tons of bituminous coal carried, making a total of 17,165,283 tons, large increases in cement, brick and lime, ores, iron machinery, etc., and a considerable decrease in anthracite coal.

Statistics of operation follow:

	1903.	1902.
Gross earnings	$63,449,633	$57,892,495
Freight earnings	47,756,251	43,779,786
Passenger earnings	12,520,988	11,238,537
Total expenses	39,569,964	37,006,984
Maintenance of way	6,175,116	7,235,389
Maintenance of equipment	8,270,156	7,384,331
Conducting transportation	23,653,780	20,946,896
Net earnings	23,879,670	20,885,511
Gross income	25,489,520	22,120,731
Deduct for misc. improvements	573,374	265,194
Interest, rentals, etc	11,097,982	12,681,762
Net income	13,818,163	9,173,775
Extraordinary appropriation	3,500,000	2,500,000
Surplus, to profit and loss	5,432,922	2,601,021

NEW PUBLICATIONS.

Air-Brake Catechism. By Robert H. Blackall. New York: N. W. Henley & Co., 1903. Eighteenth edition. Cloth, 300 pages. Price $2.

This edition of Mr. Blackall's well-known catechism of the air-brake has been completely revised, much enlarged and made to cover present practice. The last revision was made in 1900 and the improvements made in brake apparatus since that time made the present revision a necessity. Much new matter covering the most recent appliances used with the high-speed brake and the high-pressure system of control for freight equipment, has been added. About 1,500 questions and answers are given and these are illustrated with 98 engravings and three colored plates. Two of the colored plates are on too large a scale to be bound in the covers of the book and are furnished in a separate envelope. With a slight reduction in the scale of the engravings and the omission of an impressive title and margin these might well have been permanently bound with the rest of the pages with no chance of their being lost or destroyed. Otherwise the book is admirable in its arrangement and as an example of bookmaking. The index is very complete.

Fowler's Mechanical Engineer's Pocket Book, 1904. Edited by William H. Fowler. Manchester: The Scientific Publishing Company. Leather, 2s. 6d.

In the 1904 edition of this book the contents of previous editions have been thoroughly revised. Valuable data have been added and the section on gas engines has been largely rewritten with the expectation that it will prove of considerable value to those interested in gas engine design and practice. The size of the book is 4 in. x 6 in. and it contains 441 pages. Beside the leather binding, with gilt edges, it may also be had in a leatherette binding and red edges, at 1s. 6d. net.

TRADE CATALOGUES.

Ferroinclave is the name of a new steel-and-cement fireproof construction regarding which the Brown Hoisting Machinery Company, which markets it, has just issued a pamphlet circular. It is intended for roofing, siding, flooring, etc., in modern buildings, and is generally made of sheets of No. 24 or No. 22 box-annealed sheet steel. The sheets are crimped by machinery into a series of dovetails, so proportioned that the opposite ends of two sheets slide into one another and fit securely. Full-size sheets are 20 in. wide by 10 ft. long, with a depth through the dovetail of ½ in. After the Ferroinclave sheets are fastened in place the outside is coated with a mixture of one or two parts of sand to one part of Portland cement, filling up all the corrugations to a height of ⅜ in. above the top. The inside of the sheets is coated with a mixture similar to the above, to which hair has been added. The total thickness of Ferroinclave roofing is 1¼ in. The book shows numerous applications of the Ferroinclave construction, including cornices, flooring, stairways, etc. Tests of the material are described and the data given, and there are numerous photographs of buildings to which it is being applied. Cement piling may also be made of it.

Mechanical Forced Draft and *Buffalo Steel Pressure Blowers* are two little pamphlets that are being sent out by the Buffalo Forge Company, Buffalo, N. Y. The foreword of the first enumerates the considerations which led to the use of the fan for forced draft. The first nine pages briefly discuss mechanical draft vs. natural draft, and the remaining pages illustrate and describe Buffalo forced-draft apparatus, the fan system of heating and ventilating, and centrifugal pumps. The second pamphlet shows the design and construction of Buffalo steel pressure blowers, being illustrated with half-tones and line drawings, and has tables of essential dimensions. Also applications to cupola service, designs for special service, automatic cut-off engines, and a number of details are shown.

Bulletin 54 of the B. F. Sturtevant Company, Hyde Park, Mass., is a 16-page pamphlet describing the new foundry and pattern departments at Hyde Park. A description of these two shops was given in the *Railroad Gazette* of Oct. 30. Copies of this pamphlet were presented as souvenirs to the members of the New England Foundrymen's Association during a recent visit to the works.

Graphite Suggestions by The Joseph Dixon Crucible Company, Jersey City, N. J., tells of a few of the more important uses of graphite. Under "things this book tells about" are enumerated 19 different subjects briefly dealt with, including crucibles, lead pencils, lubrication, belt dressing, paint and cook stoves. The pamphlet is neat in appearance and attractively printed and illustrated.

Allis-Chalmers Company, Chicago, has issued a small pamphlet catalogue containing a partial list of foreign users of its Corliss engines, pumping engines, compressors and hoisting and blowing engines. The book contains 77 pages, and the list covers pretty nearly all of the civilized countries. The book also contains views of the five plants of the company.

Continental Car & Equipment Company, New York, has issued a car catalogue, printed in two languages—English and Spanish. It contains illustrated descriptions of the leading styles and sizes of the small cars made by the company. The company also builds many modifications of the designs shown and makes new designs for special cars.

Winter Homes is the title of an attractive booklet issued by the Southern Railway in which are described a few of the many winter resorts in the Southern States which are reached by its lines. It is illustrated with photographs of many of the larger hotels and contains a list of the best hostelries at each resort with rates and other information.

Non-Corrosive Nickel Steel Boiler Tubes.*

Boiler tubes made of steel, containing sufficient nickel to make them practically non-corrosive, have recently been successfully manufactured in this country. They were first made abroad in 1898. Tests indicate that they will last 2½ times as long as mild carbon steel tubes. Their increased strength and non-corrosive properties permit the adoption of lighter gages than at present in use, thereby increasing steaming efficiency and decreasing the weight of the boiler installation.

The first high nickel steel boiler tube made in America was finished at Shelby, Ohio, only in February last; but since then the difficulties of their manufacture have been so thoroughly overcome that the 30 per cent. nickel steel seamless cold drawn marine boiler tubes, now a commercial proposition, are made in practically the same number of operations and with but a slightly greater percentage of discard than customary in the manufacture of ordinary seamless tubes; furthermore the finished 30 per cent. nickel steel tube will stand all the manipulating tests contained in the specifications of the Bureau of Steam Engineering, Navy Department, for the acceptance of the carbon steel seamless cold drawn marine boiler tubes now in use. In addition the nickel steel tubes have a much greater tensile strength.

The greater tensile strength and elastic limit of the high nickel steel allows, without danger, the use of a lighter gaged tube than used in a given boiler when fitting it with mild carbon steel tubes. This not only partly offsets the higher cost of the nickel steel tubes per pound, but also increases the steaming efficiency of the boiler. It furthermore decreases the weight of the boiler installation, an important advantage in the case of marine boilers. The following statement, based on information furnished by the Bureau of Steam Engineering, Navy Department, shows that by substituting the lighter gages, practicable by the adoption of nickel steel tubing, the following marked saving in the total weight of boiler installation is assured: For torpedo-boats, 23,881 lbs. (10.7 tons); for battleships, 85,073 lbs. (38.0 tons).

The actual extra cost of 30 per cent. nickel steel tubes, taking the cost of the mild carbon steel tubes as a basis, is 2.13 in the case of torpedo-boat destroyers, and 2.43 for battleships. This extra cost is not prohibitory, considering the fact that the nickel steel tubes will last 2⅓ times as long as the carbon steel tubes, and that when the nickel steel tubes are finally taken out of the boilers they can be sold for the market price of steel tubing scrap, plus 20 cents per pound for the contained nickel. In the final comparison of net increased cost of the nickel steel tubes, the increased steaming efficiency due to the lighter gaged nickel steel tubes and the saving due to the less frequent retubing of the boilers, as well as the saving in weight of the boiler installation, should be given due consideration.

The probable causes of the deterioration of marine boiler tubes are summarized by Mr. Yarrow as follows: (1) To the action of acids in the water, due to grease, which, in spite of every precaution, finds its way into the boiler. (2) To the tubes becoming overheated and oxidizing on the outside through contact with hot gases when passing from the furnace to the uptake. (3) To the action of the steam, which, if superheated, decomposes, causing deterioration on the inside of the tubes. The last two conditions occur when the tubes, from defective circulation, shortness of water, or from the collection of scale, become overheated. To this summary should be added the composition of the feed-water itself, which exercises a marked influence on the corrosion of the tube.

In order to show the relative deterioration of boiler tubes due to the action of acids in the water, Mr. Yarrow made "corrosion tests" on two mild carbon steel tubes and two 25 per cent. nickel steel tubes. The four tubes were immersed in 33 per cent. hydrochloric acid for 22⅕ days, and the loss in weight at stated periods determined. The carbon steel tubes showed much greater deterioration than the nickel steel tubes.

Mr. Yarrow states that the average loss of weight in the mild carbon steel tube was 16½ times greater than in the nickel steel tube. He explains that although it may be contended that the relative corrosion of the two steels, when using dilute hydrochloric acid, does not correspond with what it would be with such acids as are present in boilers under working conditions, that it is not unreasonable to suppose that it may serve as a guide.

To determine the comparative oxidizing influence of heat upon the nickel steel and mild carbon steel tubes, Mr. Yarrow submitted two pieces of each kind of tube to what he termed the "fire test." Two tubes, one of nickel steel and one of carbon steel, were placed side by side in a small brick furnace, where they were heated to the same extent and under the some conditions. The experiment was repeated, using two tubes of the same original weight. In both cases the tubes were heated six times, and weighed after cooling and scaling. The carbon steel tubes showed much more disintegration than the nickel steel tubes. The total loss in weight of the carbon steel tubes was 78.37 per cent. and 76.06 per cent. against 24.47 per cent. and 27.66 per cent. for the nickel steel tubes.

Besides the much greater resistance to corrosion offered by the high nickel steel tubes, their greater tensile strength and elastic limit is a marked advantage over the seamless mild carbon steel tubes now in use. This increased strength is furthermore not accompanied by any detrimental reduction in the percentage of elongation, for the nickel steel tubes show no evidence whatever of brittleness. Another advantage of the high nickel steel is that any lengthening of the tube, due to expansion in service, is distributed over its entire length, whereas the soft carbon steel, as shown by its high percentage of contraction of area, generally elongates locally.

The tensile strength and elastic limit of the nickel steel tube can be varied between wide limits, but in no case are the figures as low as in mild carbon steel tubes. The tensile strength is somewhat affected by the percentage of nickel present within a range of 23 per cent. to 30 per cent., and the elastic limit can be raised by the introduction into the steel of small percentages of chromium. Both of these values are also influenced by the method used in "annealing" the finished tubes.

As might be inferred from the higher tensile strength of the nickel steel it is more difficult to draw down into tubes and is considerably tougher in working than mild carbon steel tubes. Mr. Yarrow reports that he found the German 25 per cent. nickel steel tubes "considerably tougher in working than mild steel; it involved more labor and caused greater wear and tear on the tools employed in expanding and bell-mouthing."

An American maker of stationary boilers to whom a shipment of Shelby 4-in. No. 10 gage 30 per cent. nickel steel tubes was recently made, wrote: Each of the 81 tubes was perfect, so far as we could see, and no defects developed in working. In expanding the tubes it was necessary to use considerably more care than with mild steel or charcoal iron tubes. Two or three of the sections of nine tubes each were expanded by hand with considerable difficulty; the remainder we expanded by ma-

*Extracts from a paper by Albert Ladd Colby, read before the eleventh general meeting of the Society of Naval Architects and Marine Engineers, New York, Nov. 19, 1903.

chine and found the work to go better. Owing to the constant rotation of the expander, the pin could be driven in without a tendency to force the roller out, as is the case when the expanding is done by hand.

The mechanical tests made by Mr. Yarrow on 25 per cent. nickel steel tubing give conclusive evidence of the ductility of the steel. This ductility is not impaired by sudden changes of temperature, as two tubes were bent after being heated to dull red and plunged into cold water 24 times in succession.

Manipulating tests were made on the first lot of 30 per cent. nickel steel tubes manufactured last spring by the Shelby Steel Tube Company. The tests prove that there need be no fear of brittleness in high nickel steel tubes, for the steel has stood all the manipulating tests required in the specification of the Bureau of Steam Engineering, Navy Department, for the acceptance of the carbon steel seamless cold drawn marine boiler tubes. The text of the portion of the current specification describing these tests is as follows:

"*Paragraph* 4. Tubes which are found satisfactory with respect to their surface, weight, and gage will be divided into lots of 100, and two tubes from each lot will be subjected to the following tests:

"(*a*) A piece 3 in. long, cut from the first tube, must stand being flattened by hammering until the sides are brought parallel, with a curve on the inside at the ends not greater than three times the thickness of the metal without showing cracks or flaws, the bend at one side being in the weld, if any.

"(*b*) The end of the second tube must stand being expanded cold to 1⅛ times its original diameter by driving into it a pin having a taper of 1½ in. to a foot without showing cracks or flaws. Instead of test (*b*), at the option of the contractor, an equivalent substitute test may be made as follows: Turn a flange all around the end of the tube, and of a width equal to 15 per cent. of the diameter of the tube, all the work to be done cold. If only one of the tubes so tested fails, that tube will be rejected and the inspector will select two other tubes from the same lot and subject both to the same test as the one that failed, and both of these tubes must be found satisfactory in order that the lot may be passed. The failure to pass satisfactorily either of the tests marked (*a*) and (*b*) will reject the lot which they represent."

It is well known that soft carbon steel plates and tubes, when frequently heated and cooled, become permanently reduced in length, and this fact is borne in mind in boiler designs. Mr. Yarrow's experiments indicate a slight difference in this regard between nickel steel and soft carbon steel tubes.

There is also a difference in the coefficient of expansion of the two steels. Mr. Yarrow's experiments indicated that the 25 per cent. nickel steel tube when heated to dull red expanded to a greater extent than the mild carbon steel tube. From C. E. Guillaume's careful determinations of the coefficients of expansion of different nickel steels, it appears that had Mr. Yarrow experimented with a 30 per cent. nickel steel tube, he would have found a somewhat less expansion than with the carbon steel tube.

Although this difference in expansion would be much less under usual marine boiler conditions, where the maximum pressure is 250 lbs., corresponding to a temperature of 208 deg. C. (406 deg. F.), I nevertheless agree with Mr. Yarrow that there is a possible risk in placing nickel steel tubes only in those parts of a boiler where deterioration proceeds most rapidly and using mild carbon steel tubes in the balance of the boiler. In view of Mr. Yarrow's conclusions that the nickel steel tube has at least twice the life of a mild carbon steel tube, an experimental trial of both steels in the same boiler would probably not determine the actual efficiency of the nickel steel tube, as before they needed replacing some of the mild steel tubes would fail and put the boiler out of commission. A proper comparison, and ultimately the most economical, would be when repairing the boilers of a torpedo-boat, cruiser or battleship, to retube one entire boiler with 30 per cent. nickel steel tubes and another similar boiler with new mild carbon steel tubes.

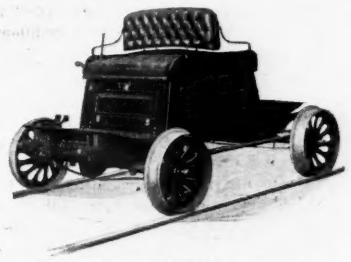
Locomotive Safe-ends.—Locomotive boilers leak at the ends of the tubes where they pass through the flue sheets. When this occurs the locomotive must be returned to the shop and the tubes expanded. This leakage is due to the compression of the soft steel tubes by the expansion of the flue sheets. The higher elastic limit of the nickel steel insures much greater resistance to this permanent deformation of the tube, and to gain this advantage without undue cost a nickel steel safe-end has been made by welding a piece of nickel steel tube about 3 in. long to a piece of soft carbon steel tube, which later can be welded on to the old boiler tube when repairing a locomotive boiler in the railroad shops. About 1,000 of these 30 per cent. nickel steel safe-ends have been recently delivered to different American railroads, and the results of this promising application of nickel steel tubing will be watched with interest.

The Germans are congratulating themselves on their success in securing contracts for locomotives from foreign countries, which are especially acceptable on account of the slack demand at home since 1899. They supplied most of those imported by Russia while it was needing so many more than it could build, and recently contracts from Spain, Italy and Japan have gone to German works. They seem to be taking the place formerly occupied by British and Belgian works. Naturally the works which have at the time the least home demand are likely to make the lowest bids.

The "Oldsmobile" as a Railroad Car.

The well-known automobile which goes by the above name is now furnished for use as a railroad inspection car, the makers having adapted it for that use by the simple expedient of fitting it with light pressed steel flanged wheels and omitting the steering apparatus; and the railroad car retains the graceful lines and the business-like appearance of the road wagon. Ease and convenience of operation and freedom from annoyances are assured by the high reputation possessed by the "Oldsmobile" road vehicles.

The inspection car is propelled by a 4½ h.p. gasoline motor of the four-cycle type. The cylinder is 4½ in.



The "Oldsmobile" Inspection Car.

in diameter and 6 in. stroke. The engine has mechanically actuated valves and "jump spark" ignition. The car is started at will by the operator, sitting on the seat, and one lever serves for all speeds and for either forward or backward motion. The car seats four persons. It will run 40 miles an hour on level track and will ascend ordinary grades. With one filling of the tanks the machine will run from 75 to 100 miles, and the cost of fuel is three-eighths of a cent a mile. The wheels are 20 in.

in diameter. The axles and underframe are of cold-rolled steel, with outer casings of No. 11 gage steel tubing.

Some improvements have recently been made in the Olds motor that will add considerably to its effectiveness. It has been lightened by reducing the water-jacket to about one-half the length of the cylinder. Heat radiating flanges are now cast on the lower half of the cylinder in place of the water-jacket, which covers only the combustion chambers and the travel of the piston head. The engine mechanism is simple, made with as few parts as possible, and each one is easily accessible. No knowledge of mechanics is required to run the car. The body of the car is finished in dark green and black, and the seats are upholstered in leather.

This car is made by the Olds Motor Works, Detroit, Mich.

New York City Transportation—A Look Ahead.

Mr. S. Whinery, a distinguished civil engineer with long experience as a railroad officer, has made a study of the New York City transportation problem, looking far into the future. It has a value more than local, inasmuch as it seems to be a model form of investigation for the solution of like problems in other cities. His paper was published in full in the New York *Sun*.

Mr. Whinery considers that at no time in the last 15 years have the street transportation facilities in New York City been adequate, and that there is nothing in the present outlook to encourage the hope that conditions are likely to materially improve in the future. The transportation improvements now under way and discussed cannot be expected to give much more than temporary relief, since, by the time they are completed, or soon afterwards, the volume of travel will have greatly outgrown their combined capacity. Portions of the article are printed below.

There is reason to believe that the population of the city of New York and the region locally tributary to it, is increasing at a more rapid rate than at any time within the last 30 years. The population of the territory now comprised in Greater New York, as given in the census of 1900, and for the preceding three decades, is as follows:

1870	1,478,103
1880	1,911,698
1890	2,507,414
1900	3,437,202

At the same rate of growth the population in 1905 will be about 4,000,000, in 1910 it will be about 4,700,000, and in 1915 it will have reached 5,500,000. If, as the facts seem to indicate, the population is now increasing more rapidly than the normal rate, these figures will be exceeded; and they may be very largely exceeded. But the population handled by the local transportation route is greatly in excess of the population figured in the census, owing to the constant going and coming of commuters, visitors to the city, etc. A circle with a radius of 20 miles from the City Hall would include a population, according to the last census, of about 4,625,000.

The number of passengers carried by the elevated roads on Dec. 22, 1902, reached the enormous total of 931,000, and on Dec. 15, 1902, the surface roads carried 1,625,127 passengers. In 1902 the average number of passengers carried by the elevated roads, daily, was 600,000, and the average number carried by all the surface lines of the greater city was about two millions, the figures representing fares collected, exclusive of transfers. Furthermore, of the whole number of passengers carried daily, nearly half traveled during the four or five busiest hours of the day. One of the most notable facts in the history of urban transportation is that the tendency of the people to use public conveyances increases much more rapidly than does the population. This is shown in a table prepared by W. W. Wheatly, in a paper read by him before the New York Railroad Club last May, giving the number of rides per capita, per year, in what is now the Borough of Manhattan, for the past 40 years.

	Rides per capita.
1860	47
1870	118
1880	182
1890	283
1900	388
1903 (estimated)	415

At the same general rate of increase, the rides per capita, per year, in Manhattan Borough, will reach 550 by 1915. Taking the official census returns for 1902, the number of passengers carried by all the local transportation lines in Greater New York was:

Passengers paying fares	about	937,817,000
Passengers transferred	about	229,307,000
Total		1,167,124,000

Assuming a population of 3,650,000 in 1902, the number of rides per capita of the population for the whole city during the year was about 320. Now, while it is not likely that the increasing ratio of rides to population will go on indefinitely, yet, it is safe to assume that there will be a material increase in the ratio in the future. We may safely estimate that by 1915 the number of rides per capita per year for the whole of the city, Manhattan included, will not be less than 400. This does not mean that every inhabitant of the city will average riding 400 times a year, since the suburban visitors and the transient visitors contribute their share. It means only that the aggregate number of rides during the year will be 400 times the population.

Should this prove true, the number of passengers to be provided for annually would reach the stupendous figure of 2,200,000,000, or just about double the number that now rides. These figures are probably conservative rather than otherwise. The conclusion must therefore follow that with present transportation facilities doubled in 1915, the congestion of travel will be at that time as great as it is to-day.

It would require to-day an increase of at least 30 per cent. in the carrying capacity of the city to serve the public with a reasonable degree of comfort and convenience. Moreover, we must take into consideration the tendency of the volume of travel to expand with increased facilities, and it is probable that 12 years from now we must be prepared to handle no less than three billions of passengers a year. This may seem to many a rash and extravagant statement, but anyone who will study and interpret rightly the history of the growth of population and of local transportation and of their relation to each other in New York, can hardly reach any other conclusion. When all that is now being done in the way of betterment and extension of the existing local lines is completed, we can reasonably hope that the aggregate capacity, including the elevated roads, will be increased more than one-third.

It is not possible with the data available to estimate very accurately the carrying capacity of the additional transportation lines now being constructed, and much less that of those contemplated at this time; but we may arrive at a rough approximation, being careful to make our figures sufficiently liberal.

The rapid transit subway road now approaching completion, with four tracks below and two above 42nd street, will probably have a capacity, on the four-track section, of 350,000 passengers a day, or, say, 125,000,000 a year. The proposed extension of two of these tracks northward under Lexington avenue, thus completing the four tracks from City Hall to beyond the Harlem River, will be a very great convenience, but will probably not increase materially the total carrying capacity, which will be measured by the capacity below 42nd street, upon which the estimate above is based.

The proposed subway No. 2 down Broadway or parallel streets to the Battery would probably have a carrying capacity not exceeding 65,000,000 passengers a year.

The additional subway branches proposed will act as feeders to the main lines, and will not materially increase the capacity of the lower Manhattan sections, where the crucial test of the whole system will be found.

The three new bridges under way over and the tunnels in progress and contemplated under the East River will have a very large carrying capacity and should relieve for a long time to come the congestion in crossing the river; but they can hardly be considered as themselves important factors in adding to the aggregate transportation capacity of the system of the greater city, since they are merely links in connecting the system in Manhattan with those in Brooklyn and Queens, and their usefulness will be measured by the capacities of the system on each side of the river. While they will provide the convenience of through communication between the boroughs, the tracks on each side of the river must have

sufficient capacity to carry through passengers to their destinations.

Projects for the construction of new lines and extensions in Brooklyn and Queens Boroughs are at present more or less chaotic, but we will probably be very liberal in estimating that they will increase the present total capacity 40 per cent. The number of passengers carried by the lines in these boroughs in 1902 was approximately 358,000,000, and 40 per cent. of this, or 143,000,000, will, on this basis, be the increased capacity.

New surface and elevated lines, longitudinal and cross-town, may add 50,000,000 to the present capacity in Manhattan, and we may bunch together probable extensions and new lines in The Bronx and allow them a capacity of 20,000,000 a year.

The projected tunnels under the North and East Rivers in the interest of the Pennsylvania Railroad are sometimes referred to as additions to the transportation facilities of the city. In one sense they will doubtless prove to be so; but since the passengers they deliver in Manhattan will largely, after reaching the great station at 32nd street and Seventh avenue, be compelled to use the local system of transportation to reach their destinations, these tunnel lines are sure to increase rather than to relieve the congestion on the local system. The same may be said of the New York Central improvements at, and north of 42nd street.

If we now collect the various quantities itemized above, we shall have as the utmost probable capacity of all the street transportation agencies that are at all likely to exist in 1915 the following:

Present carrying capacity of all local transportation lines in Greater New York	1,167,124,000
Allow that the capacity of these lines may be increased one-third, equal to	389,040,000
Estimated capacity of subway system now under construction	125,000,000
Proposed subway No. 2	65,000,000
New surface, elevated and subway lines in Brooklyn and Queens	143,000,000
New surface and elevated lines in Manhattan	50,000,000
New lines and extensions in The Bronx	20,000,000
Total	1,959,164,000

The total is, it will be observed, less than double the number of passengers carried in Greater New York in 1902, and it is 240,000,000 less than the number which we have found may be expected at that date under a continuance of the present conditions of congestion. It is about 65 per cent. of the capacity we have estimated will be required at that date to serve the public with reasonable comfort and convenience.

If these figures are open to criticism at all, it must be upon the ground that they are too sanguine. There is certainly nothing in the figures presented to warrant the expectation that the capacity of all the elevated, surface and subway lines, 12 years from now, will lessen the degree of congestion that exists at the present time.

We have thus far considered transportation with reference to the city as a whole rather than to any single section of it. While such a general view is useful in showing that no adequate scheme for supplying the necessities of the near future is now proposed, we must not lose sight of the fact that the greatest degree of congestion is now, and will continue to be, localized in a part of one borough, and that the causes producing this congestion are likely to become accentuated in the future, as the transportation facilities in other portions of the city are expanded.

A reasonable estimate of the population of Manhattan in 1915 is 2,500,000, and we have seen that at least 550 rides per capita may then be expected in the borough. This would mean 1,375,000,000 passengers per year. An estimate based upon the number of passengers carried annually in Manhattan since 1880 gives a somewhat higher result.

The population of the city is quite sure in the future to increase more rapidly outside of Manhattan than within that borough, though the business in which that population will be engaged will continue to be concentrated in the lower part of the island, and this will tend to increase the relative number of passengers more rapidly than the borough population increases. It is probably conservative, therefore, to estimate that at least 50 per cent. of the whole travel of the city will be within the Borough of Manhattan at the future date we are considering.

If so, and if the volume of travel in the whole city reaches the figure we have estimated, 3,000,000,000 passengers a year, we may expect that at that time the lines in Manhattan will be called upon to carry 1,500,000,000 passengers a year. Let us see what facilities are now in sight, or even projected, to handle this stupendous traffic 12 years from now.

As stated above, the surface and elevated lines in the borough carried, in 1902, 752,490,000 passengers. Let us assume, as we have before, that the capacity of the existing lines may be increased one-third by additional tracks and other improvements. Their capacity would then be 1,003,300,000 passengers a year.

Let us add to this the estimated capacity of the subway now under construction and of the proposed subway No. 2, and also the estimated capacity of such possible new surface and elevated lines as are even vaguely talked of in the borough, using the figures heretofore assumed.

We shall thus reach a total of a little over 1,243,000,000 a year, as the whole transportation capacity in sight, or yet proposed, to meet the requirements of the year 1915. We have estimated that these requirements will be 1,500,000,000 passengers a year.

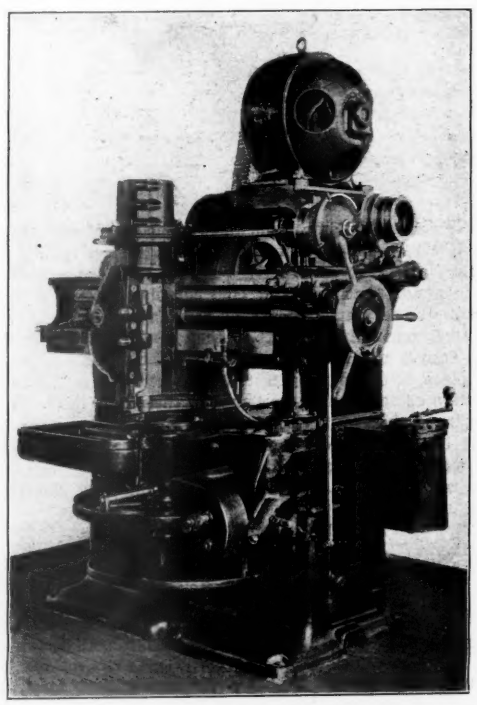
A simple example in subtraction will show that accommodations for 257,000,000 passengers a year will remain unprovided. This number is about one-third of the whole number of passengers now carried a year by all the lines in the borough, and some conception of the vastness of the problem before us may be arrived at when we consider that if all the enlargements enumerated above were provided by 1915 it would be necessary to add to them a further capacity equal to one-third of the present transportation system in order to supply the demands that are reasonably sure to exist at that time.

Unless it can be shown that the statements of fact here presented are erroneous, or that the deductions made from them are unwarranted, it must be evident to every thoughtful person that the city of New York is face to face with a very serious and important problem. If the city expects to continue her present rate of growth and to maintain her position as the commercial metropolis of America, she cannot afford much longer to ignore the gravity of the situation.

It is folly to assume that the growth and prosperity of the city may not be seriously affected and greatly retarded by failure to provide the means of free intercommunication, which are everywhere recognized as one of the most important factors of commercial prosperity. Not even her great natural advantages and her present momentum in prosperity may save her from the consequences of failure to provide the facilities which her local commerce requires, and the reasonable accommodations, in the way of safety and comfort, which modern civilization demands.

A Motor-Driven Fellows Gear Shaper.

This gear shaper differs from other forms of gear-cutting machinery in that it replaces the usual rotating milling cutter by a reciprocating tool having the form of a spur gear. This planes the teeth and at the same



Fellows Motor-Driven Gear Shaper.

time is caused to revolve with the blank, intermeshing precisely as its finished mate is intended to. In degree of accuracy this scheme compares with the hobbing method of forming worm wheels, and also corresponds very closely to it in principle. The cutters for both may be produced with extreme precision, especially for involute gearing—the only type now in common use—as both then depend on generation by straight lines. For instance, a hob is cut as a perfect V thread, and the Fellows cutter is finished by being caused to roll against the carefully-trued face of an emery wheel with a motion simulating that of a pinion tooth against a rack tooth.

To equip the Fellows shaper with individual motor drive, it was only necessary to provide a cast-iron plate to span the pillow blocks of the regular driving gear to support the motor, and substitute a sprocket wheel for the cone pulley used with belt drive. With these changes a standard form has been evolved, which is shown in the accompanying illustration. A 5-h.p. Crocker-Wheeler semi-inclosed type motor supplies the power, transmitting it with a reduction in speed through a Renold silent chain to the spindle which normally holds the cone-pulley. The speed is further reduced through either of the two regular gear combinations which are used alternately, making two speeds possible mechanically. In addition, the motor is supplied with current on the Crocker-Wheeler four-wire multiple voltage system, giving it six independent speeds, and with the use of resistance, 12 intermediate speeds.

The upper 10 of the motor's 18 speeds constitute its working range, within which, through the faster gear combination it drives the ram at from 94 to 45 strokes per minute, or with the slower gear combination, from 43 to 20. The lower eight available motor speeds may be used to extend the range down to six strokes per minute, though 20 is the minimum in ordinary practice. The machine is capable of cutting external gears up to 36 in. pitch diameter by 5 in. face, and internal gears 28 in. pitch diameter by 3 in. face, with any diametral pitch up to four. It is made by the Fellows Gear Shaper Company, Springfield, Vt.

Interstate Commerce Commission Decisions.

The Interstate Commerce Commission, in opinions by Commissioner Prouty, has announced its decisions of three cases brought by the City of Wichita.

In the first case, against the Atchison, Topeka & Santa Fe and others, it was alleged that the rate charged on grain for export from Wichita to Galveston was unlawfully higher than the export rate for the longer distance from Kansas City to Galveston, on some of which lines Wichita is an intermediate point. Competition, which does not exist at Wichita, actually controls and forces the rates from Kansas City, which are, nevertheless, remunerative to the carrier; but the present wheat rate of 30½ cents from Wichita to Galveston is held to be excessive as applied to wheat and other kinds of grain to the extent of 2 cents per 100 lbs. The Commission held, therefore, that the export rates on grain from Wichita to Galveston are unreasonable and unlawful, and should be reduced in accordance with the finding, but that the order can be directed only against the unreasonableness of such rate and not against the adjustment of export rates as between Kansas City and Wichita to Galveston.

The principle governing the decision in this case is based upon decisions rendered by the United States Supreme Court, which hold in effect that where actual competition exists at the more distant point, which does not obtain at the intermediate or nearer point, and where such competition has actually produced a lower rate at the more distant point, which the carrier cannot control and must meet to obtain a share of the business, neither the third nor the fourth section of the Act to regulate commerce prohibits the disparity in rates at the shorter and longer distance points, provided that the longer distance competitive rate is remunerative and the shorter distance point rate is reasonable.

In the second case, also against the Atchison and others, complainant alleged that carriers' rates on coal in carloads from Minden, Mo.; McAlester, Ind. T., and Russellville, Ark., to Wichita were unlawful as compared with the carriers' coal rates from the same points to Kansas City. It appeared that the rates to Kansas City are controlled and actually forced by competitive conditions governing the transportation of coal to that city, but that such rates are remunerative, and that the rates to Wichita cannot be found excessive upon the record as made in this case. Complainant is allowed until Jan. 1, 1904, to apply for leave to submit further testimony upon the reasonableness of the coal rates to Wichita.

In the third case, against the Chicago, Rock Island & Pacific, it was alleged that rates from lumber-shipping points west of the Mississippi River in Louisiana, Arkansas, and Texas to Wichita were unreasonable and unduly prejudicial as compared with rates on like traffic from the same points to Kansas City, Omaha, Lincoln and Topeka, and that such rates are higher over the lines of the Santa Fe and the Rock Island for the shorter distance to Wichita than for the longer distance through Wichita to Kansas City and the other destination points. It appeared that competitive conditions existing in Kansas City, Omaha, and Lincoln produce low rates to those points from the lumber territory in question, and that such competitive conditions do not exist at Wichita: that there is no substantial dissimilarity in the circumstances and conditions governing the transportation of this lumber to Wichita and through Wichita to Topeka by the Santa Fe and the Rock Island; and that the rate from such lumber-producing territory to Wichita is excessive to the extent of 1 cent per 100 lbs. The Commission held that all of the carriers violate section three of the Act, and the Santa Fe and Rock Island violate section four by maintaining higher lumber rates from such territory than to Topeka; and that the lumber rate from the territory described to Wichita is unreasonable and should be reduced.

Foreign Railroad Notes.

The Western of France after prolonged tests has decided to use electricity for heating several corridor trains. Ten brass foot-warmers, in two groups of five each, are to be fitted in each car.

The Belgian railroads have ordered 100 four-wheeled freight cars to carry 20 tons (44,000 lbs.) each. Few four-wheeled cars of so great capacity have been used heretofore. The large cars with which trials have been made in several European countries have been substantially like ours on trucks. It is now reported that Prussia will make 20-ton cars its standard for coal cars.

There is talk of establishing a car ferry between Dover and Calais, so that you may get into your berth in London and sleep all the way to Paris—or Moscow. It may be doubted whether a passenger would be less seasick in a car on a boat than in the boat's cabin; but he would be more secluded. Further, a great advantage is claimed for the shipment of early fruits and vegetables, which could go through to London or Glasgow in the cars in which they were originally loaded, and there is something

in that. The variation in tides of 26 ft. makes such a ferry more difficult than anything of the kind in this country.

The Austrian Railroad Ministry some time ago sent an engineer to Russia to study the petroleum-burning locomotives. On his return experiments were made on one of the State lines; the result has been such that petroleum is recommended as the fuel of all express and passenger trains on this line, which will require about 180,000 barrels yearly.

TECHNICAL.

Manufacturing and Business.

D. O. Ward, General Manager of the American Washer & Mfg. Co., has resigned, to take effect Jan. 1.

The Chicago, Milwaukee & St. Paul has entered into an agreement with the Barker Mail Crane Company whereby the road will make Barker mail cranes for its own use.

The International Navigation Company's steamship "St. Louis" has eight new Sturtevant fans for maintaining forced draft, each one of which is driven by a Sturtevant compound engine.

Bids are wanted Dec. 5, at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a 40-ton locomotive jib crane for the Navy Yard at Puget Sound, Bremerton, Wash.

The Nashville Tie Company, of Nashville, has been incorporated in Tennessee, with a capital of $25,000, to deal in railroad ties. John B. Ranson, Hamilton Lane, and others are incorporators.

The Crocker-Wheeler Company, Ampere, N. J., has established headquarters for the southern representative of its Washington office, Mr. S. M. Conant, at 425 Empire Building, Atlanta, Ga.

Robert O. Cumback, for several years with the Central of New Jersey, and now at the Elizabethport shops, is to become Superintendent of the new plant of the Pedrick & Ayer Company, at Plainfield, N. J.

John Calder has terminated his connection with the C. W. Hunt Company, of West New Brighton, N. Y., as its executive engineer, and will in future be connected with the Remington Typewriter Company at Ilion, N. Y.

The Onondaga Manufacturing & Promoting Company, Syracuse, N. Y., has been incorporated with a capital of $50,000 to make engines, etc. James D. Smith, Syracuse, and A. E. Fletcher, Canandaigua, N. Y., are directors.

The South American Construction Company, of Yonkers, N. Y., has been incorporated, with a capital of $25,000, to operate power plants. R. S. Storrs, F. D. Davey, New York City, and W. A. Walsh, Yonkers, N. Y., are directors.

It was incorrectly reported in our issue of November 6 that the business of the Chicago office of the Sterlingworth Railway Supply Co. would hereafter be transacted in Philadelphia. The Chicago agency will be maintained, as heretofore.

The Consolidated system of electric heating, made by the Consolidated Car Heating Co., Albany, N. Y., has been specified for 60 surface cars for the Boston (Mass.) elevated, and for 125 elevated cars for the Brooklyn Heights R. R.

The Pennsylvania Malleable Co., with works at McKees Rocks, Pa., has begun making the steel discs for the Schoen Steel Wheel Co., having changed one of the malleable furnaces in the plant into a steel furnace. The output is about 20 tons daily.

The Jacobs Manufacturing Company of Hartford, Conn., has been incorporated with a capital of $50,000, to make machinery and tools. Arthur I. Jacobs, of Hartford, and L. W. Ripley and Henry S. Goslee, of Glastonbury, are incorporators.

The Electric Dynamic Co., Bayonne, N. J., has been incorporated, with a capital of $50,000, in New Jersey, to make electric motors, machinery, etc. Edward P. Kingsland and Aug. Treadwell, Jr., of New York, and Burgiss A. Cruden, of Caldwell, N. J., are incorporators.

At the plant of the Lackawanna Steel Company, Buffalo, a new manager, Mr. Sheldon, formerly with the Illinois Steel Company, has been placed in charge. Vice-President Reis, who has been acting as General Manager, may go to New York to assume charge of the company's financial affairs.

The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, has recently doubled the capacity of its works for making double-refined charcoal-iron hollow and solid staybolt material. Also the storage capacity has been increased by an addition 50 ft. x 200 ft.

The Soule Dust Guard Co., Boston, Mass., is shipping 820 guards to the South Baltimore Car & Foundry Co., also 500 to the Como shops of the Northern Pacific. The Mt. Vernon Car Co. has recently ordered 1,200 guards. The American Car & Foundry Co. will soon receive shipments of Soule guards at its Milton and St. Charles shops.

The Continuous Rail Joint Company of Canada has been granted a charter in Canada, with a capital of $49,000, to make and deal in iron, steel and other metals and railroad appliances. Lawrence Fulton Braine, of Newark, N. J.; David Harry Friedman, of Albany, N. Y., and H. W. Near and C. L. Dunbar, of Guelph, Ont., are incorporators.

The George Miles Company, of Winsted, Conn., has been incorporated with a capital stock of $50,000, to make pneumatic specialties and general iron work. The incorporators are George Miles, of Hull, Mass.; David J. McSweeney, of South Boston; Alfred Schoff, of Norfolk, Conn., and Martin Sauter, of Winsted. Mr. Miles is president and Mr. Schoff secretary and treasurer. The company will occupy the Franklin Moore bolt factory.

The Delaware, Lackawanna & Western in carrying out a policy of making liberal inducements to manufacturing concerns to locate along its lines, has created an extensive industrial development throughout northern New Jersey. This region offers many advantages in transportation facilities and convenience of location for export trade. One of the largest of the new works now building is the Worthington plant of the International Steam Pump Co. at Harrison, N. J. When completed this shop will employ about 6,000 men, and will be one of the largest engineering works in the vicinity of New York. The steel framework and most of the brick work for the buildings is now up and it is expected to have the equipment placed and the plant in operation in about a year.

A wide circle of friends in and out of the trade will regret to learn of the death of John Graham Millar, manager of the roofing department of the H. W. Johns-Manville Co., 100 William street, New York City, at the age of 45 years. Mr. Millar's death occurred at St. Luke's Hospital, New York City, on October 15, from typhoid fever. He was born in Birmingham, England, of Scotch and English parentage, and came to the United States in 1885. After a short period of employment with the United States Leather Co., Mr. Millar associated himself with the business in which he was engaged at the time of his death. He had been with the H. W. Johns Company for 15 years. He was recognized as an expert in his line and introduced a number of improvements in the manufacture of asbestos roofing. Mr. Millar was widely esteemed for his integrity and many engaging qualities, and his death is a severe loss to the company with which he was connected.

Iron and Steel.

The Eastern Steel Company, which is building a large billet mill at Pottsville, Pa., will also add a foundry, machine and blacksmith shop and a new rolling mill.

The Pennsylvania Steel Company has received an order for about 20,000 tons of steel rails for the Mecca Railway. The price has not been officially stated but it is probably $22.85 a ton, delivered at Beirut.

The Pittsburg Steel Construction Company, of Allegheny, Pa., has bought land at Ambridge, Pa., on which it will build new shops. The machinery now at Allegheny will be removed to Ambridge.

Low Pressure Pneumatic Signals in India.

According to *Transport*, the Bengal-Nagpur railroad of India has decided to spend £29,250 for low pressure pneumatic signals, to be put in at Kharagpur, Adra and Santragachi.

Contract for Lightships.

The Lighthouse Board has let contract to the New York Shipbuilding Co., of Camden, N. J., for five new steel lightships at $82,000 each, to be completed in 12 months. The ships are to be able to run under their own steam and will have steam fog signals. The total cost of the vessels, including lighting apparatus not included in the bids, will be about $85,000 each.

Painting Locomotives.

There is not to-day a paint or pigment that will permanently stop corrosion. There are many which will retard it more or less, and it is true economy to select the primer, which is the protector, that will check it for the greatest length of time. I believe that carbon is the primer which will retard rust for the longest period.

There is no true economy in "slapping on" engine finish or varnish haphazard, with a dozen or more mechanics here and there undoing the work so that an engine can be discharged from the shop on a certain date in order to maintain the shop's monthly output; then after a trial have it returned for minor repairs, and by the time it is ready to take its train and really enter service, the paint and varnish is marred and scarred.

When an engine is ready for the finishing coat, instead of taking that day for the painters, why couldn't it be fired and "broke in," as it is termed, and when it is pronounced ready for service returned to the paint shop and receive the finishing coat? Certainly no time would be lost, and a day is gained in the shop by having the pit vacated a day earlier. The engine will at least look, when it takes its train, as if it had been repaired.—*A. P. Dane before the New England Railroad Club.*

A Reason for Staybolts Breaking.

When staybolts commence to burn at the inner side of the fire-box sheet, the burning continues outward until protected by the water. The heat that causes the burning causes expansion at its inner end, and in the hole of the sheet, and that expansion is met by resisting expansion in the sheet. The sheet, which may also burn, may crack between the bolts. The bolts will break, not always where the force of rigid compression exists. Sometimes the concentration of force at another part of the bolts causes it to snap under the varying vibrations and strains it has to endure.

The sheet cannot be burned so long as there is water behind it; but if burning is commenced at the inner end of the staybolt it will extend outward and imperil the sheet immediately around it. Though riveted close to the plate the inner end of the bolt is only mechanically in touch with the plate, and cannot exercise the functions of the sheet in giving to the water the heat by which it is attacked. The flexible staybolt not only offers more substance to burn, but is not in contact with the water either in the furnace or at its joints. There is only one way to avert the risk of burning from the inner end of the bolt outward, and that is with air through the center of the bolt and water around it; nor can you unduly expand a bolt of that character. It will receive the force of the expanding sheet without resisting by its own expansion to the extent a solid bolt will.—*John Livingstone before the Foremen Boilermakers' Convention, Chicago.*

Locomotive Front-Ends.

In a paper which he presented to the October meeting of the New England Railroad Club, Mr. Walter B. Leach said: Some roads have done away with petticoat pipes. It may be a question with some of us whether or not they can be dispensed with in our larger engines, as on account of the height limit it becomes necessary to use a very short stack. The short stack is much inferior to the long one, and in order to give the short-stack engine as good a draft as one with the long stack, it will probably be necessary to equip it with some additional apparatus. What the best arrangement is I am not prepared to say, but probably a well-arranged petticoat pipe or pipes would do the work.

In order to get a sufficient length of stack locomotives are equipped with the inside or drop stack. It is a question in the minds of a good many whether this is desirable or not, on account of there being no opening at the top of the arch to the atmosphere; when engines are not working, steam, smoke and gases having no natural outlet, "back up," so to speak, and come out at the furnace door. This shows that the engine has not a proper natural draft. We had some engines with the drop stack which were at best but indifferent steamers, but by removing the drop stack, which was of small diameter at the choke, and putting on a larger, straight stack, which was entirely above the arch, but was necessarily short, and by dropping the exhaust nozzle and applying the petticoat pipe, or rather two petticoat pipes, very good results were obtained. We are so completely satisfied with the change that all engines of this class are to be so changed.

We have also arranged some of our engines so that they effectually throw all the sparks out, clean the front-ends perfectly, steam well, burn a good even fire and work so well that I think it very possible that we may change others. These engines carry a high exhaust pipe with a double nozzle, and there is no petticoat pipe. We found, however, that there was an accumulation of sparks behind the steam and exhaust pipes, which, by a little alteration of the present arrangement, I believe can be eliminated. This accumulation is not serious, but may eventually work to the detriment of the engine by interfering with the draft in the bottom flues.

The force with which sparks, smoke, gases, etc., strike the diaphragm plate when it is set close to the flue-sheet and not given a good angle can be clearly seen on a plate removed from the front-end. You will find a mark opposite each flue, indicating the force with which the plate is struck.

THE SCRAP HEAP.

Notes.

The Baltimore & Ohio has made a uniform reduction from 10 hours a day to nine hours, in the work of its men in the locomotive and car shops.

The stockholders of the Atlantic Coast Line at the annual meeting in Richmond Nov. 17 authorized the directors to create a pension board, with a view to pensioning superannuated employees.

Lumbermen in the State of Washington say that their industry has lost the sale of 10,000 car loads during the past six months because the railroads could not furnish cars for shipments to eastern States.

Press despatches from Indianapolis say that a large number of freight train men of the Cleveland, Cincinnati, Chicago & St. Louis have been arrested on the charge of robbing cars. More than 40 employees are implicated.

It is announced in Chicago that on the tourist sleeping cars which are run by the Pullman Company, mostly west of Chicago, the rates are to be advanced so that the prices for accommodations in these cars will be uniformly one-half those in standard sleeping cars.

The Mexican Government has revoked the order, issued a few weeks ago, permitting the railroads to advance freight rates 15 per cent. The advance was allowed because of the low price of silver, but silver is now higher and the Government has decided, therefore, that the railroads are no longer entitled to the relief which was granted.

The Cleveland Electric Railway Co. proposes to fight the three-cent fare idea to the end. An injunction against the three-cent fare road, it is said, will shortly be applied for. Many of the property owners along the route have been induced to revoke their consents. It is the purpose of the company to keep the three-cent fare promoters tied up in the courts until the Legislature can pass a bill creating a State Street Railway Commission which will be favorable to the high fare roads.—*Press despatch from Cleveland.*

Justice Day, of the United States Supreme Court, has delivered the opinion of the court in the case of Comp-

troller Adams of the State of Tennessee vs. the Pullman Palace Car Company. The case pertained to the taxation of sleeping car companies. The court upheld the validity of the Tennessee law of 1889, taxing companies for the passengers carried solely within the State limits. The law of 1887, taxing the cars operated within the State, was held to be a burden on interstate commerce, and therefore unconstitutional.

Union Engineering Building, New York.

Some erroneous statements have appeared in daily papers which may or may not need correction; depending on the extent to which members of the engineering societies may be inclined to accept idle rumors. It is not true that "a ballot vote is now being taken by the American Society of Civil Engineers on the proposition." The officers of this society are preparing to obtain expressions from the members and to submit the matter to the next annual meeting, in pursuance of the directions given them at the Asheville convention.

A Turbine Liner for the Atlantic Service.

According to *Transport*, Messrs. Allan & Co. have ordered a turbine steamship from the firm of Workman & Clark, of Belfast, for mail service between Liverpool and Montreal. The new ship will be the largest vessel in the Allan fleet, with a gross tonnage of 12,000, and will be somewhat over 500 ft. long. The turbines are intended to develop about 10,000 h.p. and have been designed with a view to economy rather than for high speed, which is only guaranteed at 16 knots. The new vessel will be put into service next summer and will be the first turbine steamer to engage in trans-Atlantic business, although several are in successful operation in the coasting service abroad.

Disastrous Rear Collision at Kentwood, La.

Press despatches of November 14 report a rear collision on the Illinois Central on the evening of that day, at Kentwood, La., on the main line about 75 miles north of New Orleans, in which 25 or more negroes were killed and many others were injured. The victims were track repair laborers who had just been paid off and were going to town to spend their money. They were in the rear cars of an accommodation train and these were run into and crushed by an express train. The last two cars of the accommodation train were completely wrecked. The wreck took fire and was mostly burned up, and the bodies of some of the killed were destroyed, so that the exact number of persons killed has not yet been ascertained. The fireman of the express train was killed.

To Lessen Noise on Elevated Railroads.

Consul-General Hughes reports to the Government from Coburg, Germany, that experiments are being made on the Berlin elevated electric line to lessen the noise made by the cars. The first experiment consisted in inserting three layers of felt between the rails and the wooden ties on which they were laid. This was inadequate, however, although it gave some improvement. Next, hollow iron girders filled with loose sand were substituted for the wooden sleepers; this also was partially effective, but not entirely so. The rails were then laid on long longitudinal sleepers with cushions of lead under them. Finally, the car wheels have been lined with wood, so as to break the continuity of the path for vibrations through metal.

There is nothing in this that is new to American engineers, either in devices or in the apparent need for them. The problem has been met and to a great extent solved on elevated structures in cities by eliminating the effect of a sounding board with packing of any one of many non-sound-conducting materials. But the vital remedy is perfect rail surface.

New Road in Mexico.

David Moffat of Denver and financial interests identified with the Colorado Fuel & Iron Co. have made an application to the Mexican Government to build and operate a trunk line in Mexico. Col. Jos. A. Robertson who built the Monterey and Mexican Gulf Ry. is also interested. The road is to run from Douglas, Ariz., south and southeast to Guadalajara and probably to the City of Mexico. It is announced on good authority that the Mexican Government will grant the concession in the early part of January, 1904, and will give a subsidy of $15,000 per kilometer. The Mexico & Pacific Coast Line is the name of the road. Preliminary construction arrangements have been made. The new road connects with the Kansas City, Mexico & Orient at Topolobampo and also connects at Altata with a short line which runs from Altata to Culiacan, which road is owned by the Mexico & Pacific Coast Line. It will be about 1,500 miles long and will connect also with the Mexican Central at Guadalajara. It is said that the same interests will build from Douglas north to connect with Moffat's Utah-California line.

A Honduras Railroad.

The Government of Honduras has recently granted a concession to Henry A. Spears, who, according to press advices, is from Belize, for building a railroad from the Bay of Fonseca to Cantarranas, 35 miles. Rights of way have been granted in the concession, and the work of construction is to be begun within six months. In the terms of the concession the following rights and privileges are granted by the Government: To use all native woods, stone, rock or lime for construction purposes, and to take and use all coal and petroleum discovered within 31 miles of the proposed line. The right is also given to introduce foreign laborers for work on the road, with the exception of Chinese. Branch lines may be constructed wherever it is deemed necessary or convenient. As a guarantee of carrying out the terms of the concession, the grantee must deposit 10,000 pesos ($4,000) in the general treasury, to be forfeited if the railroad is not duly completed and opened to the public. The Government reserves the right to acquire the railroad by purchase, after the expiration of 50 years from the date of the approval of the concession by the Honduras Congress. —*Consular Report.*

Relative Tonnage of Leading Ports.

The Bureau of Statistics, Department of Commerce and Labor, has prepared a table showing the chief seaports of the world in their order of importance as indicated by tonnage entered and cleared in foreign trade, coastwise figures not being included. It will be seen that London is easily first and that New York is second. It is interesting to note the relative importance of the eastern trade, as indicated by the figures for Hongkong and Singapore. The table follows.

Port.	Year.	Entered, tons.	Cleared, tons.
London	1902	10,179,023	7,385,085
New York	1902	8,982,767	8,415,291
Antwerp	1902	8,373,528	8,347,483
Hamburg	1902	7,860,323	7,993,166
Hong Kong*	1901	7,383,683	7,340,586
Liverpool	1902	6,843,200	6,314,514
Cardiff	1902	4,688,088	7,868,556
Rotterdam	1901	5,950,445	5,733,763
Singapore†	1901	5,459,032	5,453,999
Marseilles	1902	4,911,784	4,552,088
Tyne ports	1902	3,615,046	4,754,301
Gibraltar	1901	4,171,350	4,159,272

*Exclusive of Chinese junks engaged in the foreign trade. The tonnage of these vessels entered and cleared was 1,126,931 and 1,930,279, respectively, in 1901. †Exclusive of war ships, transports, native craft, and vessels under 50 tons, but inclusive of vessels engaged in trade between the Straits Settlements.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

The Rocky Mountain Railway Club.

At the monthly meeting held Nov. 21, at the Union Depot, Denver, the subject for discussion was "The Training of an Engineer," by J. W. Hardy. Also answers to and discussion of the following questions:

1. Why not use malleable iron brake hangers instead of wrought iron or drop forged?
2. Is the extension piston with bearing of any account?
3. What is the best type of spider piston? M. M. Currier, Secretary.

PERSONAL.

—Mr. Frank P. Arnold, of Peoria, Ill., has resigned as Grand Secretary and Treasurer of the Brotherhood of Locomotive Firemen.

—Mr. Oliver J. Geer, who was for many years General Agent for the Pennsylvania Railroad in New York City, died at his home in Brooklyn, Nov. 13, at the age of 69.

—Mr. Thomas Pinckney, for many years with the Norfolk & Western, and at the time of his death General Eastern Agent, died at his home in Morristown, N. J., Nov. 11. Mr. Pinckney was born at Old Point Comfort, Va., in 1839, and was a graduate of Princeton College.

—Mr. P. H. Reeves, who succeeds Mr. Smith as Division Master Mechanic of the Baltimore & Ohio South Western at Chillicothe, has been in railroad service since he was 11 years old, having begun with the Marietta & Cincinnati as an apprentice in the machine shop in 1874. He was promoted through the stages of gang foreman, roundhouse foreman, erecting shop foreman and general foreman, and on the first of this month was appointed Master Mechanic.

—Mr. J. A. Shepherd, Superintendent of Transportation of the Western Maryland and the West Virginia Central & Pittsburg, began his railroad service on the Wabash in 1892. Starting as an assistant agent at Homer, Ill., he was, the following year, promoted to the position of operator and worked as such in various offices until 1897, when he was appointed Despatcher at Decatur, Ill. In 1898 he was made Assistant Chief Despatcher, and in January, 1902, was appointed Chief Despatcher, which position he has held until now.

—Mr. H. O. Halsted, Superintendent of the Detroit District of the Pere Marquette, began his railroad career on the Union Pacific in 1884, and remained with the U. P., in various capacities until 1893, when he went to the Flint & Pere Marquette. In 1895, he left this road, being appointed Superintendent at Swan River, Minn., for the Duluth, Mississippi River & Northern, but soon returned to the F. & P. M. as Agent in charge of Terminals at Toledo. In 1902 he was transferred to Grand Rapids as Chief Despatcher, and in August this year was made Trainmaster; three months later he was promoted to be Superintendent at Plymouth, Mich.

—Mr. F. J. Smith, the new Master Mechanic of the Washington (Indiana) shops of the Baltimore & Ohio Southwestern, is about 42 years old. Mr. Smith's entire railroad service has been with the B. & O. S. W., beginning at the age of 17 as an apprentice at Chillicothe, Ohio. Four years later he was sent to Portsmouth, Ohio, as machinist, and in 1883, he was made Foreman of the Shops at Hamden, Ohio. Later he became roundhouse foreman at Chillicothe, but in a short time was transferred to Cincinnati and later to Seymour, Ind. From this latter position in 1899 he was promoted to be Master Mechanic at Chillicothe, which position he now leaves to become Master Mechanic at Washington, Ind., to succeed Mr. Hair.

—Mr. J. R. Nelson, Superintendent of the Canadian Pacific, is a native of Montreal, having been born in 1876. He began work on the Canadian Pacific at the age of 16 as a junior clerk in the Purchasing Department. Two years later he was transferred to the Vice-President's office and subsequently became his private secretary. In 1897 he held a similar position in the President's office, and in 1901 was made Chief Clerk, from which position he is now promoted to that of Superintendent at North Bay.

—Mr. R. H. Soule, at one time Superintendent of Motive Power of the Erie Railroad and later its General Manager, and still later a general consulting engineer, after an interruption of nearly three years, has returned to the active practice of his profession. He is an engineer of distinguished ability and has special knowledge of shop layouts, plans, and specifications, both for railroad shops and for industrial establishments. His address is No. 20 West 34th street, New York.

—Mr. George H. Webb, the new Assistant Chief Engineer of the Michigan Central, is a graduate of the Pennsylvania Military College, class of 1880. In that year he was for a time with the New York & Brooklyn Suspension Bridge testing materials, and was also a rodman on the Somerset & Cambria (B. & O.). Subsequently he was City Engineer of Johnstown, Pa.; engineer for the Johnson Steel Rail Company, Division Engineer on the Seattle, Lake Shore & Eastern Railroad, and (for two years) on railroad building in Chili. From 1894 to 1897 he was in private business at Williamsport, Pa., and in the latter year was made Chief Engineer of the Cincinnati, Georgetown & Portsmouth. Later he became Supervisor of Track on the Cleveland, Cincinnati, Chicago & St. Louis. For a time he was on the St. Louis, Iron Mountain & Southern, and in the early part of 1903 became Division Engineer of the Michigan Central, from which position he is now promoted to be Assistant Chief Engineer. Mr. Webb is a member of the American Society of Civil Engineers and of the American Railway Engineering & Maintenance of Way Association.

ELECTIONS AND APPOINTMENTS.

Canadian Pacific.—Charles H. Hines has been appointed Electrical Engineer, with headquarters at Montreal.

Chicago & North Western.—The Minnesota and Dakota Division of the C. & N. W. has been divided into two divisions, to be known as the Minnesota and the Dakota Divisions. W. D. Beck has been appointed Superintendent of the Minnesota Division and O. H. McCarty, hitherto Assistant Superintendent at Winona, Minn., has been appointed Superintendent of the Dakota Division. A. L. Goetzmann, hitherto Superintendent of the Minnesota and Dakota Division, has resigned. G. J. Quigley, hitherto Assistant Superintendent at Chicago, has been appointed Superintendent of the Northern Iowa Division, with headquarters at Eagle Grove, Iowa, succeeding Mr. Beck. J. W. Doyle has been appointed Assistant Superintendent, with headquarters at Boone, Iowa, succeeding G. W. Dailey. William Walliser, hitherto Trainmaster, has been appointed Assistant Superintendent, with headquarters at Chicago, Ill.

Chicago, Milwaukee & St. Paul.—B. F. Van Vliet, Superintendent at Milwaukee, Wis., has been transferred to the General Superintendent's office. E. D. Wright, hitherto Superintendent at Kansas City, Mo., has been transferred to succeed Mr. Van Vliet, and E. Laas, hitherto Superintendent of Construction, has been appointed to succeed Mr. Wright.

Cincinnati, Bluffton & Chicago.—A. C. Atherton has been appointed General Superintendent and Purchasing Agent, with headquarters at Bluffton, Ind., of this road, which is now building between Huntington and Union City. (See R. R. Construction, April 17, page 289.)

Coahuila & Pacific.—L. I. Westrich has been appointed Superintendent.

Erie.—J. H. Taylor, hitherto Superintendent of the Bradford Division, has been appointed Superintendent of the Delaware Division, with headquarters at Port Jervis, N. Y., succeeding G. W. Dowe, transferred, as Superintendent of the Rochester Division, with headquarters at Rochester, N. Y., succeeding E. T. Reisler, who in turn has been transferred as Superintendent of the Bradford Division, with headquarters at Bradford, Pa., succeeding Mr. Taylor, effective Nov. 20.

Missouri, Kansas & Texas.—W. L. Seelig has been appointed Auditor. G. J. Pollock, General Auditor, has resigned, and that position as well as the position of Assistant General Auditor, has been abolished.

Missouri Pacific.—J. E. Snedeker has been appointed Acting Superintendent at Jefferson City, Mo., Mr. M. Stillwell having been granted leave of absence on account of illness.

New Orleans Belt & Terminal.—N. C. Carroll, General Freight Agent, with headquarters at New Orleans, La., has resigned.

New York, Chicago & St. Louis.—C. E. Bartlett has been appointed Advertising Agent, with headquarters at Buffalo, N. Y.

New York, New Haven & Hartford.—P. R. Todd has been elected First Vice-President; F. S. Curtis, Second Vice-President, and W. E. Barnett, Third Vice-President. H. McK. Twombly has been elected a Director, succeeding Chauncey M. Depew, resigned.

Pennsylvania.—R. Ellis has been chosen a Director, succeeding the late William L. Elkins.

Eliot Sumner, hitherto Assistant Engineer of Motive Power at Buffalo, N. Y., has been appointed to a similar position at Altoona, Pa.

St. Louis & San Francisco.—C. W. Hillard has been elected a Director, succeeding M. T. Cox, resigned.

Southern.—W. L. Williamson, hitherto Trainmaster, has been appointed Superintendent of Terminals at Jacksonville, Fla., succeeding A. Tripp, resigned.

Southern Pacific.—W. R. Scott, hitherto Assistant Superintendent at Sacramento, Cal., has been appointed Superintendent, with headquarters at Ogden, Utah, succeeding J. S. Noble, resigned. H. B. Breckenfeld has been appointed to succeed Mr. Scott at Sacramento.

Wiscasset, Waterville & Farmington.—A. H. Durgin, formerly with the Maine Central, has been appointed Assistant Superintendent, with headquarters at Waterville, Me., succeeding F. B. Hubbard, Superintendent, resigned.

LOCOMOTIVE BUILDING.

The Erie is having 50 locomotives built at the Rogers Locomotive Works.

The Dominion Atlantic is having one locomotive built at the Baldwin Works.

The Cuba Eastern is having one locomotive built at the Cooke Works of the American Locomotive Company.

F. M. Hicks, of the Hicks Locomotive & Car Works, has sold the following locomotive equipment: One 65-ton mogul, and two 53-ton locomotives to C. H. Sharp, contractor; one 40-ton locomotive to Patton & Gibson.

The Delaware & Hudson, as reported in our issue of Nov. 6, has ordered four simple switching (0-6-0) locomotives from the American Locomotive Company. These locomotives will weigh 138,000 lbs.; cylinders, 19 in. x 24 in.; diameter of drivers, 51 in.; Wooten boiler, with a working steam pressure of 180 lbs.; heating surface, 1,785.32 sq. ft.; 269 Shelby tubes, 2 in. in diameter and 11 ft. 5¼ in. long; fire-box, 106 5/16 in. long and 96¾ in. wide; grate area, 74 sq. ft.; tank capacity, 4,200 gal. of water and eight tons of coal. Special equipment includes Westinghouse American brakes, Cambria steel axles, Samson bell ringers, Keasbey & Mattison boiler lagging, Diamond brake-shoes, Dressel headlights, Hancock injectors, Cyprus journal bearings, U. S. metallic piston rod and valve rod packings, Consolidated safety valves, Leach sanding devices, Nathan sight-feed lubricators, Ashcroft steam gages, Latrobe steel driving wheels, cast iron tender wheels and 44-in. wheel centers.

CAR BUILDING.

The American Car & Foundry Company has miscellaneous orders for 16 cars.

The Pullman Company is reported to be asking bids on from 250 to 400 coal cars.

The Peoria & Eastern is reported to have ordered 50 flat cars from the Pullman Company.

The De Queen & Eastern has ordered 12 flat cars from the American Car & Foundry Company.

The Atchison, Topeka & Santa Fe has ordered 15 refrigerator cars from the American Car & Foundry Company.

The Morrell Refrigerator Line, Ottumwa, Iowa, has ordered 32 refrigerator cars from the American Car & Foundry Company.

The Lorain Steel Company has ordered 30 specially designed steel ore cars of 100,000 lbs. capacity from the Standard Steel Car Company.

The Michigan Alkali Company, Detroit, has ordered 33 hopper bottom steel cars of 100,000 lbs. capacity from the Standard Steel Car Company.

F. M. Hicks, of the Hicks Locomotive & Car Works, has received the following orders for equipment: St. Louis & Hannibal, one first class passenger coach; Patton & Gibson Company, 10 flat cars and one tank car; Interurban Railway Company, 10 flat cars; Globe Refining Company, 10 tank cars; Northwestern Cooperage & Lumber Co., a number of logging cars; Western Electric Co., five construction cars; Bon Air Coal & Iron Co., four gondolas, and the Omaha Cooperage Co., four barrel cars.

The Atchison, Topeka & Santa Fe, as reported in our issue of Oct. 30, has ordered 100 tank cars of 80,000 lbs. capacity, and 525 refrigerator cars of 60,000 lbs. capacity, from the American Car & Foundry Co. The tank cars will be 35 ft. long and 8 ft. 7 in. wide, and the refrigerator cars will be 40 ft. long, 8 ft. 2¾ in. wide and 7 ft. 3 in. high, inside measurement. Special equipment for both includes Westinghouse brakes, Miner draft rigging, malleable journal boxes and journal box lids, and cast steel truck bolsters.

The Missouri Pacific, as reported in our issue of Oct. 16, is having five wide vestibule dining cars built at the Wilmington Works of the American Car & Foundry Co. These cars will be 70 ft. 6 in. long over end sills, 10 ft. wide over side sills, and 10 ft. 6 in. high from bottom of sill to top of deck. Special equipment includes: Steel axles, double bolsters, Diamond special brake-beams, Westinghouse brakes, lead-lined brasses, Forsyth curtain fixtures, Pantasote curtain materials, bronze door fastenings, Gold heating system, cast iron journal boxes, pressed steel journal box lids, Pintsch gas and Consolidated electric light, steel platforms, canvas roofs, six-wheel trucks and 38-in. Paige steel tired wheels.

The El Paso & Southwestern, as reported in our issue of Aug. 7, has ordered three combination baggage and express cars, three combination cafe and parlor cars, and three first class passenger coaches from the Pullman Company. The baggage and express cars will be 65 ft. 7¾ in. long, 9 ft. 8 in. wide, and 6 ft. 7½ in. high from sill to plate. The cafe and parlor cars will be 70 ft. long, 9 ft. 8 in. wide, and 6 ft. 10 in. high from sill to plate. The passenger coaches will be 66 ft. long, 9 ft. 8 in. wide and 6 ft. 10 in. high from sill to plate. Special equipment for all includes National-Hollow brake-beams, Janney couplers, Westinghouse brakes, Ryan dust guards, Pullman double coil heating system, Standard roofs, six-wheel Pullman trucks, and 36-in. Paige wheels. The parlor cars and passenger coaches will be equipped with Forsyth curtain fixtures and Pantasote curtain material.

BRIDGE BUILDING.

BOSTON, MASS.—The Cambridge Commission, it is reported, will receive bids up to Dec. 23 for the material and building the steel superstructure of the Cambridge bridge.

CLAREMORE, IND.—A toll bridge may be built over the Verdigris River at a cost of about $12,000.

CLEVELAND, OHIO.—The Board of Public Service has approved a resolution appropriating $30,000 for the building of a bridge over Doan Brook at Doan street.

COVINGTON, KY.—The town trustees and the Louisville & Nashville may build a steel viaduct from State street to Russell street, at a cost of $60,000, over the railroad tracks in Central Covington.

CRESTLINE, OHIO.—The Pennsylvania, it is reported, is preparing plans for widening many of its bridges on the line of the Pittsburg, Fort Wayne & Chicago between Crestline and Toledo. Otto Schroll, Superintendent, Toledo, Ohio.

DECATUR, IND.—The Fort Wayne & Springfield Railway Co. is having plans made for a two-span bridge 150 ft. long over St. Marys River.

DELPHI, IND.—Bids are wanted Dec. 7, by Carroll County Auditor, for building two bridges; also for the stone abutments. James C. Smock, Auditor.

DULUTH, MINN.—The city will soon ask bids for the building of an aerial bridge over the ship canal, the only former bid received, that of the Modern Steel Structural Company of Waukesha, Wis., for $100,000, having been rejected.

FULLERTON, NEB.—Bids are wanted Dec. 10 for building a steel highway bridge over Loup River near Fullerton; also a steel highway bridge over north and south tunnels of the same river near Genoa, with approaches. David Stephens, County Clerk.

GREAT NECK, N. Y.—The town board of trustees has awarded a contract to the New York & New Jersey Bridge Company to build a cantilever bridge 600 ft. long and 40 ft. wide, at a cost of about $18,000, over the mill pond to replace the present structure.

GREENSBURG, PA.—Bids are wanted Nov. 27, at the office of Comptroller John H. Brown at Greensburg, Westmoreland County, for the building of a stone and steel bridge 84 ft. long over Jacobs Creek.

HAMILTON, ONT.—An agreement has been reached between the city and the Grand Trunk for the building of bridges at Ferry and Wellington streets, of a total length of 1,350 ft., to be built by the latter.

HARTFORD, CONN.—The New York, New Haven & Hartford, local reports state, will build a new double track bridge across the Connecticut River at Windsor Locks to replace the present structure.

HOUSTON, TEXAS.—The Galveston, Harrisburg & San Antonio is making plans for the building of a new steel bridge over the Rio Grande at El Paso. The company is also building a steel bridge over Devil's River.

INDIANAPOLIS, IND.—Bids are wanted Nov. 30, by Marion County Board of Commissioners, for a bridge over a creek at New Bethel in Franklin Township. Harry B. Smith, Auditor.

JERSEY CITY, N. J.—Bids are wanted Dec. 1, by the joint Committee of Freeholders of Essex and Hudson Counties, for building a bridge on the Newark plank road over the Hackensack River.

KANKAKEE, ILL.—Bids are wanted Dec. 19, by the City Engineer, for furnishing the plans and specifications for a concrete steel bridge to be built over the Kankakee River at Washington avenue. The bridge is to be 600 ft. long x 30 ft. wide, with asphalt pavement and concrete sidewalks 5 ft. 4 in. wide.

KANSAS CITY, KAN.—The bids received Nov. 9 for building the bridge over the Kansas River at Fifth street were: Missouri Valley Bridge & Iron Works, $38,991; American Bridge Company, $39,495; Midland Bridge Company, $39,497; St. Paul Foundry Company, $56,000; Minnesota Steel & Machinery Co., $44,588; Pan-American Bridge Company, $42,017; Penn Bridge Company, $41,400; Milwaukee Bridge Company, $45,000; Kansas City Bridge Company, $40,500; A. M. Blodgett, $44,000; Des Moines Bridge & Iron Works, $49,900; Canton Bridge Company, $41,850, and E. L. Deldine, $41,700. Frank Holcomb, County Clerk.

KANSAS CITY, MO.—Residents of Argentine are agitating the question and preparing a petition to be presented to the Board of Commissioners of Wyandotte County, for the rebuilding of the old county bridge over the Kaw River between North Argentine and Armourdale.

KENOSHA, WIS.—Plans have been prepared for the building of a bridge over the Kenosha River at Middle street at a cost of about $13,000.

LOS ANGELES, CAL.—Bids are wanted Jan. 5 by H. J. Lelande, City Clerk, for building the combination wood and steel bridge at Fourth street; also for the combination wood and steel bridge at Macy street. (Nov. 6, p. 803.)

MONTREAL, QUE.—A swing bridge is to be built over the Lachine Canal at St. Paul. Address Superintending Engineer, 2, Place d'Armes, Quebec, Canada.

NEWPORT, PA.—The Pennsylvania, it is reported, will contribute $23,000 towards rebuilding the Juniata River bridge; also an additional $2,000 towards the cost of extending the western abutment 40 ft. into the river.

NEW YORK, N. Y.—Sealed proposals will be received by H. Fernstrom, Chief Engineer, New York Central & Hudson River Railroad Co., Grand Central Station, New York, up to 3 p.m., Nov. 24, 1903, for the construction of the substructural work for bridge H-40 B. B. to carry Woodlawn Road over the tracks of the New York & Harlem Railroad about one-half mile north of the Station at Bronx Park.

The Williamsburg bridge over the East River between Manhattan and Brooklyn is to be opened Dec. 19.

PAWTUCKET, R. I.—The committee on streets and bridges is trying to arrange for the building of a new bridge over the river at Cross street, the probable cost of which will be about $50,000.

PORT JERVIS, N. Y.—Contract has been awarded to the Owego Bridge Company, of Owego, N. Y., for building a bridge 650 ft. long, of two spans, over the Delaware River at Port Jervis.

PORTLAND, ORE.—Plans are ready, it is reported, for building a bridge at Union avenue, to cost about $80,000; also for one at Grand avenue to cost a similar amount. W. C. Elliott is City Engineer.

ROCKDALE, IOWA.—The County Commissioners, it is reported, have decided to build a bridge 120 ft. long, on steel tubes, over Catfish Creek.

ROGERS, ARK.—Bids are wanted Nov. 21, by E. L. Taylor, County Judge, Bentonville, for the building of a steel and wood bridge 520 ft. long over White River to cost about $12,000.

SCRANTON, PA.—Petitions have been received for the building of bridges at Blakely, La Plume, Winton, Olyphant, Greenfield, Dunmore and a number of other places in the county.

SOUTH BEND, IND.—The Board of County Commissioners will receive bids for building a plate girder bridge of nine spans, 730 ft. long and 54 ft. wide, with piers and abutments of concrete, over the St. Joseph River at Colfax avenue. J. M. Brown, County Auditor.

SPOKANE, WASH.—Bids will soon be asked for building the high bridge over Hangman Creek. It is to be a plate girder and have a wooden trestle. The county has agreed to pay half the cost, an amount not to exceed $25,000. Address City Engineer Gill.

SUNBURY, PA.—The State has awarded a contract to the York Bridge Company for the building of the new steel bridge over Shamokin Creek. There were about 20 bidders, with prices ranging from $13,999 to $16,000.

TOLEDO, OHIO.—The collision of a steamer with the draw of the Wheeling & Lake Erie bridge over the Maumee River caused damages to the structure amounting to about $30,000, and closed navigation on the river as well as preventing trains crossing the bridge.

VINCENNES, IND.—Bids are wanted Dec. 10 by J. D. Williams, County Auditor, for building six iron bridges in Knox County.

WASHINGTON, D. C.—A bill authorizing the Secretary of War to build a memorial bridge across the Potomac River to Arlington was introduced in the United States Senate on Nov. 16. The cost of the bridge is to be not over $5,000,000.

WASHINGTON, PA.—The Washington County Grand Jury has approved the recommendation of the viewers for the proposed bridge over the Monongahela River from Donora, in Washington County, to Westmoreland County. The matter now only waits for the confirmation of the court.

WICHITA, KAN.—Bids are wanted Nov. 28, by the Board of Commissioners, for the building of three bridges, with an agreegate length of 150 ft.

Other Structures.

BEAUMONT, TEXAS.—The Southern Pacific, local reports say, has under consideration plans for the building of a new passenger station; also a freight house.

LIVINGSTON, MONT.—The shops of the Northern Pacific, local reports say, will be enlarged early next year.

MINNEAPOLIS, MINN.—The Chicago Great Western, local reports say, will enlarge its present passenger station at Tenth avenue, South, by adding another story; also build additions to the freight house and lengthen the train sheds.

POINT RICHMOND, CAL.—The Southern Pacific will apply for a franchise to the Board of Supervisors for permission to build wharves, two each 2,600 ft. long, connected at their outer extremities by a wharf 1,000 ft. long.

WASHINGTON, D. C.—Bids will be received until 12 o'clock noon, Dec. 8, by the Department of the Interior, for the building of about 18 miles of canal pressure pipes and tunnels, with head works, spill-ways and gates, from Salt River, about 25 miles north of Globe, Ariz. Bids must be submitted separately for the tunnels, the pressure pipes and the other structures. Plans may be obtained from Arthur P. Davis, Phœnix, Ariz.

WEST ALBANY, N. Y.—Sealed proposals will be received by H. Fernstrom, Chief Engineer, New York Central & Hudson River Railroad Co., Grand Central Station, New York, up to November 24, for the building of a brick power station, 92 ft. 3 in. wide by 113 ft. 4 in. long, at the West Albany yard in the Town of Colonie, Albany County, N. Y.

YOUNGSTOWN, OHIO.—It is reported an agreement has been reached by the Erie and the city, whereby the Erie will build a passenger station, also a viaduct and make track improvements in Youngstown.

ZANESVILLE, OHIO.—The Baltimore & Ohio it is reported, will build a brick freight station at Zanesville, also one at Cambridge.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALABAMA ROADS.—Press reports state that the Cedar Creek Mill Company, of Brewton, Ala., will build a railroad from Brewton north to timber lands in Escambia and Conecuh Counties. T. R. Miller is President.

ARKANSAS SOUTHERN.—An officer writes that surveys are now in progress for an extension from Winfield, La., southeast to Alexandria, 45 miles. No contracts have as yet been let.

BROCKVILLE, WESTPORT & NORTHWESTERN.—This company, which was recently incorporated by an act of the Dominion Parliament, will take over on Nov. 23, the Brockville, Westport & Sault Ste. Marie, which runs from Brockville, Ont., to Westport, 45 miles. It is proposed to extend the line eventually from Westport to

North Bay, 250 miles. John Gerkes, World Building, New York, is President.

Brockville, Westport & Sault Ste. Marie.—See Brockville, Westport & Northwestern above.

Buffalo, Rochester & Pittsburg.—It is reported that E. C. Lauer, Rochester, N. Y., has received contracts for building a second-track from Punxsutawney to Stanley, 11 miles, and from Carmen to Ridgeway, eight miles. The estimated cost of the improvement is $1,400,000.

Cache Valley.—An officer writes that the proposed route of this road is from Newport, Ark., via Sedgwick, in a northeasterly direction along the west slope of Crawley's ridge to the State line of Missouri. Contract for the first 10 miles has been let to E. P. C. Biggs. Five miles have been graded but no track has been laid. The work is light with slight grades and maximum curves of 2 deg. There are no important trestles and only one large bridge which is that across the Cache River, one mile northeast of Sedgwick. W. T. Blackford is Chief Engineer, and H. A. Culver is General Manager, both of Sedgwick, Ark. (Nov. 13, p. 882.)

California & Oregon Coast.—Articles of incorporation have been filed by this company in Oregon. The proposed route is from Grant's Pass, Ore., in a southwesterly direction through Wilderville, Selma and Kerby to Crescent City, Cal., with branch lines from Smith River to Chetco, Ore., and from a point near Crescent City in a southerly direction to a point in Humboldt County. The entire length of the new line, including branches, is about 100 miles. H. H. Ludlow, B. V. Thomas, M. S. Wilson and others are incorporators.

Caspar, South Fork & Eastern.—It is reported that surveys are completed for half the distance from Caspar, Cal., east to Willits, 35 miles. Three miles of track out of Caspar have been laid. R. E. Andrews, Caspar, Cal., is Chief Engineer. (Sept. 25, p. 698.)

Chesapeake & Ohio.—It is reported that this company will have its extension now building from Whitehouse, Ky., southwest to Pikeville, completed and in operation as far as Paintsville, 10 miles, by Jan. 1. Langhorn, Johnson & Co. are the contractors. (See Construction Supplement.)

Chico & Northern.—This company has been incorporated in California. It is proposed to build from a point one mile south of Chico, in a northwesterly direction to Sterling, 32 miles. J. W. Helman, H. M. Holbrook, of San Francisco, and C. A. Harp, of Stockton, Cal., are incorporators.

Cleveland, Lorain & Wheeling.—This company has let contracts for improvements at Bellaire, Ohio. The work includes a revision of the grade and double tracking between Bellaire and Bridgeport, and a new connection between the Bellaire bridge and the Cleveland, Lorain & Wheeling to allow both northbound and southbound trains to pass to the main line without reversing as is now the custom.

Danville & Bloomsburg Electric.—Rights of way are reported secured for this proposed electric railroad from Danville through Riverside and Mechanicsburg to Bloomsburg, 10 miles. W. F. Pasco, Allentown, Pa., is President.

Detroit, Flint & Saginaw.—Surveys are reported in progress on this proposed railroad from Detroit northwest to Flint, 55 miles. W. W. Hunt, Saginaw, Mich., is Chief Engineer.

East St. Louis & Columbia.—This company has been incorporated in Missouri, to build a railroad from East St. Louis, Ill., northwest via Waterloo to Columbia, Mo., 100 miles. T. N. Chase, P. J. Meyers and others, of East St. Louis, are interested.

Eureka & Klamath River.—This road has been extended from Little River Junction, Cal., south to Luffenholtz, four miles, and is now in operation between these points. (See Construction Supplement.)

Flat Top R. R.—Surveys have been completed and rights of way secured for this proposed railroad from Raleigh, W. Va., up Beaver Creek to Bramwell, 35 miles. Contract for grading the first 20 miles will shortly be let. C. E. Hawker, Fairmont, W. Va., is President, and G. W. Milnes, Clarksburg, is Chief Engineer. (June 19, p. 449.)

Galesburg, Monmouth & Rock Island (Electric).—A contract has been let to the Chicago Engineering & Construction Company for grading this line from Galesburg, Ill., north to Rock Island, 40 miles. Work will be begun at once. S. L. Nelson, Galesburg, Ill., is General Manager. (June 12, p. 416.)

Gulf & Ship Island.—An officer writes that work is now in progress on an extension from Mendenhall, Miss., to Silver Creek, 29 miles. J. C. Alexander, Hattiesburg, Miss., has the contract for furnishing the ties and building the trestles on this line. Location surveys have been completed between Silver Creek and Columbia, 27 miles. W. W. Vail, Gulfport, Miss., is Chief Engineer.

Gulf, Colorado & Santa Fe.—Contract has been let to the Grigsby Construction Company for building a branch line from Bragg, Texas, to Saratoga, 10 miles. C. F. W. Felt, Galveston, Texas, is Chief Engineer.

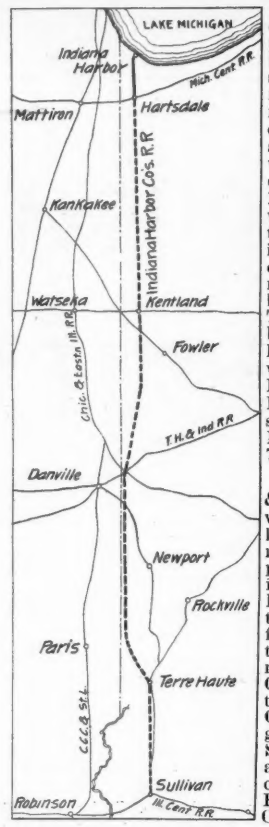
Great Northern.—An officer writes that this company is not planning to build a branch line from Wenatchee, Wash., up the north bank of the Columbia River to Chelan Falls.

Kelleys Creek & Northwestern.—This company has completed four miles of its line from Cedar Grove, W. Va., a point on the Kanawha & Michigan, up the valley of Kelleys Creek to Ward. Surveys for building the remainder of the line northwest to Sutton are in progress. (Official.) J. W. Dawson, Cedar Grove, W. Va., is General Manager. (Nov. 6, p. 804.)

Lewiston & Kennebec (Electric).—Articles of incorporation have been filed by this company in Maine. It is proposed to build an electric railroad from Lewiston, Me., through Webster, Wales, Monmouth, Litchfield and West Gardiner to Gardiner, 21 miles. M. S. Bird, Rockland; G. W. Heselton, Gardiner; J. D. Clifford, Lewiston, and others are incorporators.

Manistee & Repton.—An officer writes that a contract will be let in a few days for building an extension of this road from Shiverville north to Monroeville, Ala. The road runs at present between Manistee and Manistee Junction, 19 miles. The contract will call for the completion of the extension by the end of the year. W. H. Louisell, Manistee, Ala., is President. (Nov. 6, p. 804.)

Mexican Central.—Press reports state that an extension is being built from the City of Mexico south to the Guatemala frontier, to connect with the northern end of the Guatemala Central R. R.



Indiana Harbor.—An officer writes that the proposed route of this railroad is from Hartsdale, Ind., south to Sullivan, 171 miles. Contracts for grading, track laying, bridges, etc., will be let in February, 1904. The contract will call for the completion of the road by January, 1906. The work is heavy, with a maximum curvature of 3 deg., and a maximum grade, southbound, of 20 ft. per mile, and a maximum grade, northbound, of 15 ft. per mile. There will be four steel bridges on the line. Oakleigh Thorne, 135 Broadway, New York City, is President, and C. W. Hotchkiss, 401 LaSalle street, Chicago, is Chief Engineer. (Oct. 23, p. 768.)

Kansas City, Mexico & Orient.—An officer writes that this company has completed over 100 miles of road during the past year. Work is now in progress on a line from Kansas City, Mo., to Milton, Kan., 228 miles, and from Fairview, Okla. T., to Sweetwater, Texas, 297 miles. The International Construction Company and the Union Construction Company are doing the greater part of the work. Seven miles of double track are also under construction on the Kansas City, Outer Belt & Electric, at Kansas City.

Mexican Roads.—It is reported that a company is about to be organized by David Johnson, of Mexico City, for building a railroad from Juarez, through Colonna, Dublan and Colonna Juarez to the Pacific coast.

Midland R. R. of Nova Scotia.—It is reported that this company is about to build from Truro, N. S., north to Brule, 32 miles. Connection will be made with the Intercolonial at both points. H. V. Harris, Truro, N. S., is President.

Minneapolis, St. Paul & Sault Ste. Marie.—The Winnipeg line of this road, extending from Glenwood, Minn., northward to the White Earth Indian Reservation in Norman County, 125 miles, has been completed and is now in operation as far as Carlos, 24 miles. (Oct. 30, p. 786.)

Mississippi Roads.—The Fernwood Lumber Company is asking bids on five miles of grading. Profiles and estimates may be secured at the company's office at Fernwood, Miss.

New York Central & Hudson River.—At a meeting of the Aqueduct Commission held on Nov. 17, a final agreement was reached between the city and the New York Central R. R. According to this agreement, the railroad must remove its tracks from the land needed for the Croton dam, and in return the city will furnish the railroad with a new right of way west of the dam.

New York, New Haven & Hartford.—An officer writes that work is now in progress on the further extension of second track on the Naugatuck Division, approximately 2½ miles. J. J. O'Brien Contracting Company, Bridgeport, Conn., is the contractor.

O'Connell R. R.—Surveys are reported in progress for this railroad from Gallagherville to Coatesville, Pa., four miles. The new line will parallel the Pennsylvania between these points. It is stated that contracts for grading will shortly be let. T. E. O'Connell, Westchester, Pa., is President, and C. B. Lear, Jr., is Chief Engineer. (Nov. 6, p. 804.)

Ogden & Northwestern.—Articles of incorporation have been filed by this company in Utah, to build a railroad from Ogden to Brigham City, 20 miles. T. D. Dee is President, and H. H. Spencer, Vice-President, both of Ogden, Utah.

Oklahoma City & Western.—Surveys have been completed for this proposed line from Oklahoma City to Carmen, Okla. T., 118 miles. C. G. Jones, Oklahoma City, is President.

Pacific & Idaho Northern.—It is reported that this company is about to extend its line, which runs from Weiser, Idaho, northeast to Council, 60 miles, to Meadow, 20 miles. Work will probably be begun in the spring. L. A. Hall, Weiser, Idaho, is President.

Pennsylvania.—It is reported that this company is about to resume work on the improvements which were temporarily suspended about the middle of October. This work includes extensive grade improvements between Columbia and Parkesburg, and between Thorndale and Paoli, on the Philadelphia Division. (Oct. 23, p. 768.)

Pittsburg, Binghamton & Eastern.—At a special meeting of the directors of this company, a contract was awarded to the Binghamton & Pittsburg Construction Company of New York, for building this railroad from Binghamton, N. Y., southwest to Ansonia, Pa., 80 miles. J. W. Burke is the engineer in charge of the work.

Pittsburg, Carnegie & Western.—It is reported that J. W. Patterson, President and Chief Engineer of this road, has said that the line from Jewett, Ohio, through Patterson's Mills and Carnegie to Pittsburg, will be opened for traffic about Jan. 1, 1904. The line is entirely completed with the exception of the bridge over the Monongahela River. (Sept. 11, p. 660.)

Quebec & Southern.—An officer writes that work is practically completed between St. Francis du Lac and Pierreville, one mile. The Canadian Bridge Company has the contract for the bridge work. Surveys have been finished for an extension from Pierreville, Que., to Levis, 91 miles.

St. Louis & North Arkansas.—An officer writes that a line is projected from Leslie, Ark., southeast to Little Rock, 110 miles. Location surveys will probably be made in the spring. G. L. Sands, Eureka Springs, Ark., is Vice-President of the company.

St. Louis, Memphis & Southeastern.—An officer writes that work is now in progress on extensions of the St. Louis & Gulf Division from Zeta east to Vanduser, 11 miles, and from Bloomfield southwest to Campbell, 34 miles, all in the State of Missouri. McArthur Bros., Chicago, Ill., are the contractors. This work will be completed by March 1, 1904.

Southern.—An officer writes that the second-track between Alexandria, Va., and Manassas, 26 miles, has been completed and is now in operation. Grading between Manassas and Orange, 52 miles, is about one-half completed, and 12 miles of track has been laid between these points. The company expects to have 22 miles of double track between Catletts, Va., and Culpeper in operation by the end of the year. (Nov. 6, p. 804.)

Suffolk & Carolina.—An officer writes that surveys are now in progress for an extension from Beckford, N. C., west to Gatesville, 11 miles. The line from Beckford to Elizabeth City has been completed.

Sumpter Valley.—This company has let a contract to the Utah Construction Company of Ogden, Utah, for building from Whitney, Ore., west to Tipton, 6½ miles. The work is heavy. J. C. West, Ogden, is the engineer in charge of the work. (Oct. 23, p. 768.)

Tabasco Central.—This company has been organized in Mexico for the purpose of building a railroad from San Juan Bautista, in the State of Tabasco, to a point on the Seco River. Policarpo Valenzuela, San Juan Bautista, is President of the company. It is stated that the necessary financial arrangements have been made for building the road at once.

Tilsonburg, Lake Erie & Pacific.—An officer writes that this company proposes to build a line from Ingersoll, Ont., to Collingwood, 125 miles. Location surveys will shortly be made. John Charlton, Lynedoch, Ont., is President.

United R. R.—This company has been incorporated in Colorado to build a railroad from Crevasse, on the Denver & Rio Grande, north through Mesa, Garfield and Rio Blanco Counties. Surveys are now in progress. A. C. Chisholm and W. N. Vaile, of Denver, Colo., are incorporators.

Washburn & Northwestern.—This road has been completed from Hines, Wis., on the Chicago, St. Paul, Minneapolis & Omaha to a point on the Empire Logging Company's line, three miles east of Dedham, a total distance of 30 miles. The road is for logging purposes only, and is owned by the Edward Hines Lumber Company of Chicago.

Wichita Valley.—Contract for building an extension from Wichita Falls, Texas, northeast in the direction of Benvanue, is reported let to Manly Bros. J. W. Field, Wichita Falls, is the engineer in charge of the work. (Oct. 23, p. 768.)

Wilkesbarre & Hazleton.—An officer writes that surveys are now in progress from Ashley, Pa., to Wilkesbarre, three miles.

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Central of Nova Scotia.—See Halifax & Southwestern below.

Delaware Valley.—This company, which runs from East Stroudsburg, Pa., to Bushkill, 13 miles, was sold on Nov. 10, on a judgment for $1,705. The purchase price is subject to a mortgage of $190,000, held by the Wilbur Trust Company, of Bethlehem, Pa., as trustee.

Erie & Central Canal.—This road, which runs between Cortland, N. Y., and Cincinnatus, 19 miles, has been sold to J. S. Bull. The purchase price is reported to be $100,000. The road was opened May 1, 1898.

Halifax & Southwestern.—The name of the Central R. R. of Nova Scotia has been changed to the Halifax & Southwestern.

Interurban Street Railway (New York).—In order to avoid the confusion due to the similarity of the names of the Interurban and the Interborough railway companies, the name of the Interurban has been changed to the New York City Railway Company.

Long Island.—At the next meeting of the stockholders of this company on November 24, a vote will be taken to approve the following propositions: 1. To lease New York & Rockaway Beach. 2. To lease Long Island R. R. North Shore branch. 3. To mortgage property, rights and franchises to secure an issue of bonds to be used for refunding obligations and existing debts.

New York City Street Railway.—See Interurban Street above.

Northern Pacific.—This company has made a two-year loan of $7,500,000, at 5 per cent., with Baring Bros. & Co., Ltd., of London. The loan is secured by $10,000,000 St. Paul, Minneapolis & Manitoba Pacific extension sterling 4s, due July 1, 1940. The collateral is deposited with the Bankers Safe Deposit Company of New York. It is reported that the entire issue has been sold in London.

Pittsburg, Cincinnati, Chicago & St. Louis.—This company has issued $4,750,000 preferred stock, with the privilege of allowing shareholders of record Dec. 1, to subscribe to the same at par to the extent of 10 per cent. of their holdings. Of the $30,000,000 preferred stock authorized, the company has issued $22,701,000.

St. Louis, Iron Mountain & Southern.—The New York Stock Exchange has listed $12,242,000 River and Gulf divisions first mortgage 4s, due in 1933. The bonds have been issued as follows: $7,200,000 to acquire 152 miles of the St. Louis Valley R. R., including ferry and terminal properties; $148,000 for a similar amount of the first mortgage bonds of the Union R. R. Co. of Memphis; $3,089,251 to pay for 132 miles of railroad acquired from the White River R. R. and the Memphis, Helena & Louisiana R. R.: $1,208,938 for 45 miles of extension on said roads: $489,143 for equipment; $106,857 for ferry facilities and for equipment covered by mortgage as direct lien.

Southern Pacific.—It is announced that this company, which has hitherto owned 50 per cent. of the Maricopa, Phœnix & Salt River R. R., running from Phœnix, Ariz., to Maricopa, has acquired the remaining half interest in this line. It is stated that the road will be operated in future as a direct branch of the Southern Pacific System.